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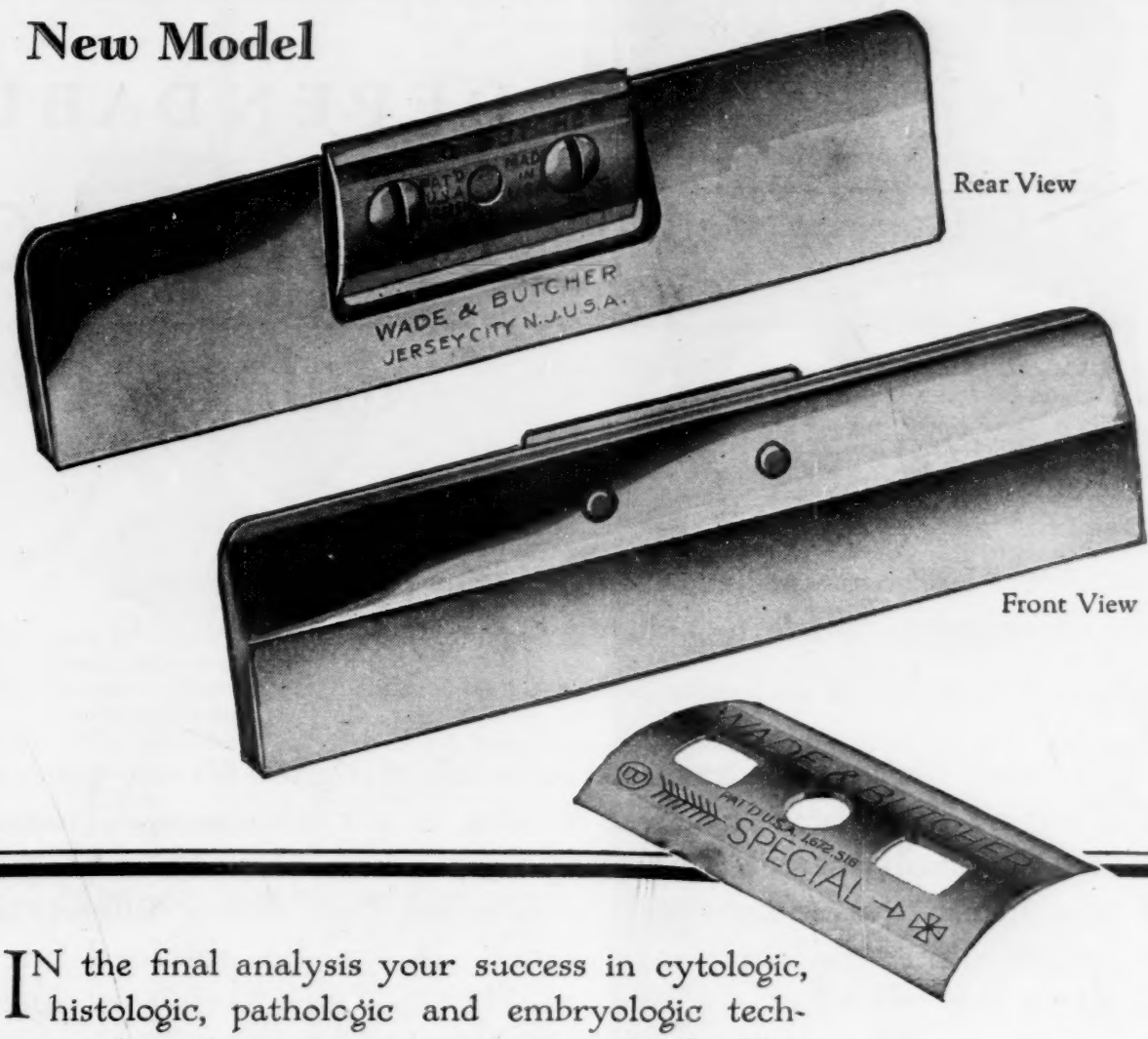

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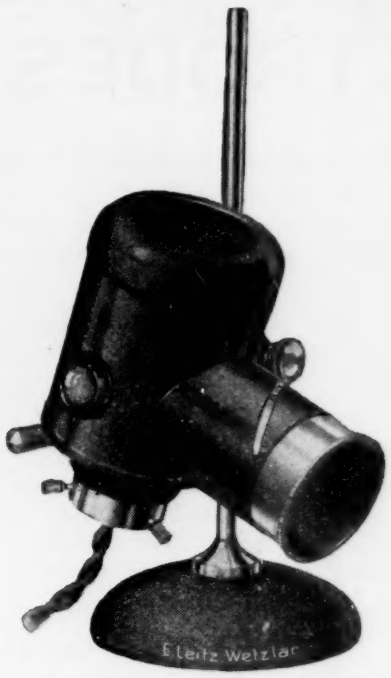

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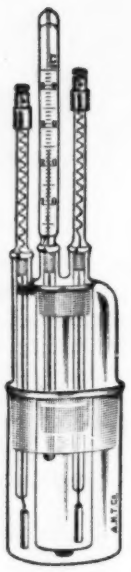

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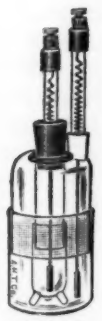

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SCIENCE

VOL. LXX — FRIDAY, AUGUST 30, 1929 — No. 1809

The Thirteenth International Physiological Congress: Address of Welcome: PROFESSOR WILLIAM H. HOWELL 199

The Progress of Physiology: PROFESSOR AUGUST KROGH 200

Reminiscences of the Early Days of the Physiological Congresses: PROFESSOR LÉON FREDERICQ 205

Obituary: Recent Deaths 207

Scientific Events: The Botanic Garden of the University of Cambridge; Demonstrations of Biological Work at Woods Hole; International Lighthouse Conference; The Mathematics of Engineering 208

Scientific Notes and News 211

University and Educational Notes 214

Discussion: Shaler on the Fossil Brachiopods of the Ohio Valley: DR. ROBERT TRACY JACKSON. *Ions and Electrical Currents in the Upper Atmosphere:* DR. E. O. HULBURT. *Muybridge Animal Pictures:* PROFESSOR WALTER R. MILES. *A Unified System of Presenting Bibliographies:* DR. J. L. ST. JOHN. *A New Blue Crayfish:* CURTIS L. NEWCOMBE 214

Quotations: Electrical Research 218

Scientific Books: Weaver and Clements on Plant Ecology: PROFESSOR FRANCIS RAMALEY. *Naumann's Grundlinien der experimentellen Planktonforschung:* PROFESSOR C. JUDAY 218

Scientific Apparatus and Laboratory Methods: A Simple Method for Finding Any Particular Object in a Microscope Slide Preparation: DR. EDWARD C. ROSENOW 219

Special Articles: Studies of Mean Sealevel: PROFESSOR DOUGLAS W. JOHNSON. *Segregations Observed in Breeding the Monilia Bread Molds:* DR. B. O. DODGE 220

Science News x

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ADDRESS OF WELCOME OF THE PRESIDENT OF THE THIRTEENTH INTERNATIONAL PHYSIOLOGICAL CONGRESS[1]

By Professor WILLIAM H. HOWELL

THE JOHNS HOPKINS UNIVERSITY

MAY I express to you first the gratification and pride that we physiologists of the United States feel in welcoming the Thirteenth International Physiological Congress to our own country. It was only about fifty years ago, barely the space of a single lifetime, that physiology in this country began its career as an independent science with special facilities for instruction and research and for the training of its own group of workers.

Before that period individuals here and there had made notable contributions to the subject. Beaumont, Dalton, Flint, Weir Mitchell and Wood are names especially to be remembered. But the real birth of physiology with us began with the establishment of the laboratories of Bowditch at Boston, of Newell Martin at Baltimore and of Chittenden at New Haven. Into these laboratories were transplanted from Europe the spirit and methods of modern physiological research. Their directors were pupils of Ludwig and Bernard, Michael Foster and Kühne, and they grafted upon our medical courses the conception and practice of physiology as an experimental science along the lines laid down by the great masters of our modern era, Claude Bernard and Johannes Müller.

From these modest beginnings have sprung the splendid laboratories in experimental physiology and medicine which we now possess. Our workers are numbered by the hundreds and our contributions to the advancement of the subject increase constantly in importance. We look upon this meeting of the congress at Boston as a recognition that American physi-

[1] Harvard University, August 19, 1929.

ology has come of age, and has been admitted to full membership in that old world group to whom we have so long looked for guidance and inspiration.

There was one among our number, who, alas! is with us no longer, Dr. Samuel J. Meltzer, whose heart would have been greatly stirred by this occasion. Born in Russia, educated in Germany, he passed the greater part of his professional life in this country, beloved and respected by all and a strong influence for good in the development, not only of physiology, but of scientific medicine in general.

His last days were spent amid the distracting events of the great war, and the needless spread of the animosities of that conflict into the serene domain of science was a source of the deepest regret and sorrow to him. The closing years of his life were given to an earnest effort to reestablish the bonds of brotherhood among scientific workers in medicine by the formation of a Fraternitas Medicorum which should bind us together in a common purpose to advance the welfare of humanity. The ideals that he visualized are in process of fulfilment through the instrumentality of these international congresses. They constitute, in fact, a fraternity of scholars whose essential object is the unselfish promotion of knowledge for the benefit of the whole of mankind. This large assembly from all quarters of the globe is convincing proof of the potency of a great humanitarian ideal to rescue international amity among men of science from the evil effects of the stresses and passions engendered by political and economical differences.

If, as citizens of the United States, we feel a natural pleasure and pride in welcoming our foreign members as guests to our own country, this human emotion is in reality subordinate to the more profound sense of satisfaction that we experience in cooperating with you, our brothers and colleagues, as fellow citizens of the great republic of science, whose beneficent purposes command our common loyalty without respect to national boundaries or political separations.

The pleasure we feel in meeting again after an interval of three years is saddened by the thought that during that period some of our company who stood high in our esteem and in the record of their achievements have finished their work forever.

Starling, of England, whose ability and brilliant personality made him the natural center of these world gatherings; Magnus and Einthoven, of Holland, to whose work both physiology and medicine are so deeply indebted; and Kossel, of Germany, whose contributions to biochemistry were of such fundamental significance, were veterans in the service. They were among our greatest and most admired leaders, and they have left enduring records of their work in the history of physiology. Noel Paton, Ferrier, Anderson, Pütter, Wieland, Mandel were fruitful workers whose names have long been honored among us. Pezard, of France, and Arthur Loevenhart, of this country, were cut down in young manhood before the fine promise of their early work had reached its full accomplishment. We mourn the loss of these gifted colleagues, and as a mark of respect to their memory I ask the congress to rise and stand for a moment in silence.

THE PROGRESS OF PHYSIOLOGY[1]

By Professor **AUGUST KROGH**

DIRECTOR OF ZOOPHYSIOLOGICAL LABORATORY, UNIVERSITY OF COPENHAGEN

I SUPPOSE that almost every worker in our science has given some thought to the general progress of physiology and to the problems raised by its growth, and I can not doubt that some have pondered deeply over these problems and have much more insight into them than I possess, but you must admit that on the whole the thoughts have been kept private, and nobody seems to have considered it worth while to bring the matter up for a general discussion among physiologists. When I venture to do so it is because I feel deeply the importance of the subject, and in spite of the fact that I feel even more deeply my own lack of competence in all questions involving organization. My aim is only to draw your attention to some of the problems in the hope that means may be found to solve them.

We are all aware that physiology is a rapidly expanding science in the sense that an ever-increasing amount of work is being produced by an increasing number of workers, and the increase in attendance at the international congresses bears witness to the fact. I have tried to count from the abstracting and indexing journals the number of papers published on physiological subjects. The figures are probably not strictly comparable, but their general tendency is unmistakable. In the first year of this century, the year of the congress in Turin, titles were given in the *Physiologisches Zentralblatt* of 3,800 papers, and during the first decade only minor fluctuations took place. I find from the *Zentralblatt* and *Bibliographia* 3,900

[1] Opening address before the Thirteenth International Physiological Congress, at Harvard University, August 19, 1929.

in 1904 (congress in Brussels), 3,500 in 1907 (Heidelberg) and 4,300 in 1910 (Vienna), but then a rapid increase took place and in 1912 the figure was 6,700. I have no reliable statistics for the years from 1913–1919, but for 1920 the *Jahresbericht* gives the titles of 11,500 papers; for 1923 (Edinburgh) the figure is 14,000 and for 1926 (Stockholm) it reached 18,000, and there is no doubt that it is increasing further. I had the impression that physiological papers now were on an average shorter than 25 years ago, but a sample counting failed to substantiate this impression and showed the average length to be then as now 10 pages. The increase in publication is due to a number of causes and to some extent it may be unreal and due to more complete indexing now, but there can be no doubt that much more work is done now and by a larger number of workers than 25 years ago. It is interesting to note that in the *Zentralblatt* for 1901 only 100 papers or 2½ per cent. were published in America or by American authors while the *Berichte* for 1926 shows about 3,500 American papers, nearly 20 per cent. of the total.

Our science has grown also in the sense that our understanding of many problems of fundamental importance has been broadened and deepened. We are all more or less familiar with the enormous expansion of knowledge in the field of nutrition and in the study of hormones. Less spectacular, but I think equally important progress has been made in the physiology of muscle and nerve and in the problems of the circulation. We have become acquainted recently with the long-continued work of Pavlov and his school on the cerebral functions, and I think we can say that the investigation of the nervous system is making satisfactory progress in spite of its tremendous complication.

Physiology has been brought in much closer contact with the allied and fundamental sciences. Twenty years ago the application of statistical and mathematical analysis to our problems was very uncommon and unfamiliar to most physiologists, and there were even those who deprecated it violently. Though there is still room for much further progress the statistical weapons are wielded successfully by a large and increasing number of investigators.

In many ways the results and methods of pure chemistry and physics are utilized and successfully adapted to our problems, and I trust we can claim some reciprocity, since the use of micromethods, initiated mainly within our domain, where their services are invaluable, is spreading to other provinces of science. It is extremely gratifying from a general point of view to see how even the most advanced ideas and methods of physics and chemistry are inspiring the work of a few of our colleagues. I use the words "from a general point of view" on purpose, because for my own part the fact shows me that development is taking place along lines where I can not follow and I believe we have to admit that with the rate at which advance is now taking place in the sciences the useful span of life in the front line of research is likely to be cut short for many of us, because our view-points and even our methods become antiquated.

While we have every reason to rejoice over the growth and progress of our science I think we must admit at the same time that there is room for much improvement and even that some aspects of the situation are unsatisfactory. Physiology is growing unwieldy. It is impossible for any single human being to be familiar with modern physiology in all its branches in the sense in which the great teachers of 20 or more years ago were familiar with the physiology of their time. We have to face the splitting up of physiology into more or less separate and independent sciences, and we are confronted with the problem of finding the right lines of cleavage. Research is bound up closely with teaching, and the lines of cleavage are determined and will be determined to a very large extent by the university chairs and departments which are brought into existence. It is the practical teaching situation which has made pharmacology an independent science, while as a branch of research it can scarcely be distinguished from pure physiology. We have seen biochemistry grow up and obtain independent chairs and laboratories in the universities of many countries, and I believe we all agree that this has been a most happy development which will be carried on into those universities and medical schools which have not yet effected the separation.

A few universities, and Copenhagen among them, have made a new departure in creating separate chairs and department for biophysics. This is justified from the point of view of teaching and for other practical reasons, but I do not think it is the thing most urgently needed from the point of view of research with which we are here concerned. Our physical problems have so far usually been rather elementary, but I must admit that the situation is rapidly changing and it is quite possible that new discoveries like that of radiations from rapidly growing tissues may in a near future make biophysical departments generally desirable or even necessary.

It is natural and useful that laboratories specialize in certain directions, and such specialization is sometimes accentuated by their official status, so that they may be laboratories for the study of definite problems or groups of problems as endocrinology, muscular work, etc. I do not think, however, that cleavage of

physiology along such lines will become permanent or general, and I feel sure that harmful results would be inevitable if it did become general and effective. The activities of the organisms which we are studying are too intimately correlated to allow much specialization of this kind. A serious attack on any definite problem may lead into a different province of physiology, and fortunately the workers are usually free to carry on the attack regardless of artificial boundaries.

Physiology as a science has taken its origin from the necessities of practical medicine, and even now the large majority of workers in physiology have had the benefit of a medical education and hold their appointments in medical schools. Nevertheless we all hold physiology to be an independent science, and most of the work done in physiological laboratories has no direct relation to medicine. The line of development which I think should be followed is to establish in one direction a branch of physiology which is much more intimately in contact with practical medicine and in the other direction a branch which is much more independent.

I think that work done on this side of the Atlantic has contributed more than anything else to the growing understanding of the fact that the problems of disease are mainly physiological and can not be solved by the methods of clinical observation, morbid anatomy, bacteriology or serology alone, even in cases where these sciences are absolutely essential. It is the functional reaction of the organism to the attack of disease and to the therapeutic measures which is after all the central problem. A large and increasing proportion of physiological research is carried on in hospital laboratories by men and women who are at the same time practicing the art of healing. Much of this work is very valuable, but sometimes the outlook is rather narrow, and I believe that a great deal could be gained by expert physiological direction and coordination. I think the time has come when special chairs and laboratories should be established for the physiology of disease, morbid physiology or experimental medicine, if you prefer that name. The main point is that the leaders of such laboratories should have no regular duties connected with the treatment of patients, but they must have a small number of beds at their disposal for the temporary study of selected cases, and they must of course be in close and constant contact with the clinical wards. It goes without saying that they must have facilities for studying disease experimentally on animals. Within the field of blood circulation and innervation of blood vessels with which I am personally acquainted, I have had the desirability and even necessity of cooperation with the practical medicine brought home to me again and again. I have learned also that the theoretical problems regarding kidney function require for their solution a close study of clinical cases, and I can not doubt for a moment that great benefit to patients will ultimately result from such a study. Much can be done in this direction by means of existing facilities, but I anticipate an acceleration of progress from the creation of special chairs as outlined, and I feel sure that the resulting contributions to practical medicine would amply and within a short space of time repay the communities for the initial outlay on such departments and for their maintenance.

The other line of development which I would suggest is not perhaps such a pressing need, but ultimately I believe it to be of scarcely less importance. It is the creation in the science schools and in close cooperation with the departments of zoology of chairs and laboratories for comparative physiology, animal physiology or zoophysiology. The name does not matter much, though I confess that there is one name with which I have no sympathy—that of "general" physiology. I suspect that it is often used to denote just those aspects of a problem which are considered most important from an individual point of view. In my opinion a general physiology which can describe the essential characteristics of matter in the living state is an ideal to which we may hope that our successors may attain after many generations, and I want to emphasize that the route by which we can strive toward the ideal is by a study of the vital functions in all their aspects throughout the myriads of organisms. We may find out, nay, we will find out before very long the essential mechanisms of mammalian kidney function, but the general problem of excretion can be solved only when excretory organs are studied wherever we find them and in all their essential modifications. Such studies will be sure, moreover, to expand and deepen our insight into the problems of the human kidney and will prove of value also from the narrowest utilitarian point of view.

For a large number of problems there will be some animal of choice or a few such animals on which it can be most conveniently studied. Many years ago when my teacher, Christian Bohr, was interested in the respiratory mechanism of the lung and devised the method of studying the exchange through each lung separately, he found that a certain kind of tortoise possessed a trachea dividing into the main bronchi high up in the neck, and we used to say as a laboratory joke that this animal had been created expressly for the purposes of respiration physiology. I have no doubt that there is quite a number of animals which are similarly "created" for special physiological purposes, but I am afraid that most of them

are unknown to the men for whom they were "created," and we must apply to the zoologists to find them and lay our hands on them.

I want to say a word for the study of comparative physiology also for its own sake. You will find in the lower animals mechanisms and adaptations of exquisite beauty and the most surprising character, and I think nothing can be more fascinating than the senses and instincts of insects as revealed by the modern investigations.

Just as in the case of pathological physiology, a good beginning has been made in the study of this group of problems and an increasing number of papers are published which can be justly classed as comparative or zoophysiological. There are a few chairs and departments in this branch of our science, but I suggest that it is time to increase their number, to coordinate efforts, to offer and to invite cooperation with zoology departments, with field biology and zoological investigation also along the morphological lines. I venture to believe that such cooperation will be fruitful not only to the physiologists seeking it, but also to our elder brethren in the departments of zoology.

The establishment of new chairs and departments requires the sympathetic interest and active cooperation of faculties and university authorities, but there are many points on which we ourselves individually and by our united efforts can improve unsatisfactory conditions in physiology and increase the efficiency of physiological publication.

When I try to picture the evolution of physiological truth I am struck by the similarity with the evolution of life itself upon our planet. Ideas are conceived, facts are elaborated with immense joy and with infinite labor. A large number die without ever coming to the light of publication, and of those which are published an appalling proportion sink to the bottom and can only be dug out as fossils from dusty library shelves. Many succumb in controversies with other ideas and facts and a minority only survive in the sense that they beget new ideas and give rise to the discovery of new facts. I believe that this enormous waste is on the whole inevitable and bound up inseparably with the difficulties which physiological investigation has to overcome. I look upon controversy especially as one of the chief ways in which truth is approached. We may fondly imagine that we are impartial seekers after truth, but with a few exceptions, to which I know that I do not belong, we are influenced and sometimes strongly by our personal bias and we give our best thoughts to those ideas which we have to defend. Nevertheless we should of course all do our best to avoid controversy, in the sense that we should take every possible care to verify our facts and substantiate our conclusions before publishing our results.

When I attempt to pass in review the physiological literature of to-day I notice certain defects which are too common and which could no doubt be remedied to a certain extent. In a recent small book of instructions for medical writers I find the statement that what is needed in scientific papers is facts and again facts and still more facts. I venture to disagree emphatically with this statement. Facts are necessary, of course, but unless fertilized by ideas, correlated with other facts, illuminated by thought, I consider them as material only for science. I am prepared to submit the thesis, revolting though it may seem, that too many experiments and observations are being made and published and too little thought is bestowed upon them. It is a statement not too infrequently met with in physiological papers that a certain experiment has been repeated on, say, 47 animals. Very often, though by no means always, such a routine procedure is sheer waste of time and animals, and at the root of the apparent diligence lies a mental inertia which carries the experimenter along the accustomed groove with a minimum of exertion of the mind. But physiological experimentation which shall lead to reliable results and carry us forward requires constant exertion, constant attention to details which may be trivial or may turn out to be of vital importance.

When experimental results are found to be in conflict with those of an earlier investigator the matter is often taken too easily and disposed of for instance by pointing out a possible source of error in the experiments of the predecessor, but without inquiring whether the error, if present, would be quantitatively sufficient to explain the discrepancy. I think that disagreement with former results should never be taken easily, but every effort should be made to find the true explanation. This can be done in many more cases than it is actually done; and as a rule it can be done more easily than by anybody else by the man "on the spot" who is already familiar with essential details, but it may require a great deal of imagination and very often it will require supplementary experiments.

It is an almost invariable custom of editors of journals to reject papers which do not contain new "facts." It is natural to be skeptical toward reasoning not supported by facts, but it must happen in many cases and to many physiologists that their thoughts are illumined by facts which were incompletely understood by those who brought them forward, and I remember more than one occasion where published experiments could be given a much more consistent explanation than that adopted by

their authors. In such cases a more liberal interpretation of the rules of the journals would serve the interest of our science, and I venture to think that the publication of papers discussing facts already known should be encouraged.

I have said enough and perhaps too much on the things we can do individually. What can we do as a body? The catchword of our post-war times is organization. Can physiology be organized? When I was very much younger I had visions of leaders of physiology who could see clearly the problems to be studied and the ways of approaching them, and who might distribute them and their separate parts among the laboratories and the individual workers. At a somewhat later stage I imagined a central laboratory to which all new methods could be submitted for testing and from which only the most reliable and quickest methods would emanate. I see clearly now that all such schemes are dreams. They can never be realized and should never be realized if it could be done. The individual freedom is our chief asset, the mainspring of the really new ideas, the guarantee of progress. Physiology does not go forward as an ordered line of battle on a continuous front, but must be carried on, as some one has aptly said, as a guerilla warfare against the unknown, conducted singlehanded or by quite small units. There is no need for an extensive organization of research, but there is much need for voluntary cooperation on a limited scale between individuals and laboratories. There are many problems which can only be successfully attacked when experimental physiologists cooperate with histologists, with chemists or physicists or with clinicians, and some problems will require the combined efforts of several of these groups, but the affair is always one of local and voluntary cooperation and does not concern us here.

While I have no faith in organization on a large scale of research I think there is a wide and fruitful field for organization of what we might term the services behind the front. We all feel the difficulties of keeping abreast of the literature, and I can not doubt that the methods of indexing, abstracting and reviewing that literature could be improved and organized so as to give better service at less cost. It may be desirable to adopt a system of indexing papers according to the subjects dealt with and, if it is desirable, *one* system ought to be agreed upon and used by all the leading physiological journals and by department libraries throughout the world. It is quite conceivable that even an inferior system universally adopted would be much better than many excellent systems in use locally or a general lack of system.

We have I think a very good abstracting service. I am best acquainted personally with the German abstracts in *Berichte,* and a high tribute should be paid to their general excellence and completeness. Very few papers in the leading languages escape their vigilance, but when I look over the numbers one by one as they come to hand to keep myself informed about the subjects in which I am interested I always feel that the distribution and arrangement could be considerably improved.

It is I think a wasteful procedure that the same papers are independently recorded and abstracted in several different languages and an even greater number of different abstracting journals. It ought to be possible to obtain some arrangement for exchange of abstracts and other mutual help and thereby effect also a saving in cost. Then there is the difficult question of getting abstracts of papers in less known languages like the Scandinavian or Russian.

I can not but feel that a large number of separate copies go to waste because they are distributed to people who can not utilize them, and that on the other hand separate copies of certain papers may be badly wanted by people who can not get them. I have been considering for years the possibility of an organization which could prevent some of this waste, but I have to confess that so far I have been unable to discover any workable scheme.

After all, it is not my business to point out to you specific remedies for this or that, but to suggest if possible broad measures which may lead to the solution of some of our difficulties. I believe that the machinery for dealing with problems affecting us all can be created without serious difficulty. The International Congress of Physiology is without any doubt the highest authority in matters pertaining to the organization of physiology and its necessary services. Why should not the congress exercise this authority?

We have met together for friendly intercourse, to be taught and to teach by demonstration of experiments and discussion of papers. The benefit to our science from a meeting like this is very great, although very difficult to estimate by visible results. Why should we not make this, our congress, which meets together regularly, into an instrument also for the organization of our necessary services, for the elaboration of rules of nomenclature and for the protection of our scientific freedom. I believe that it can be done and ought to be done.

Perhaps I am still a dreamer of dreams. I know for certain that I have not that administrative capacity which is necessary to transform my dreams into living realities, but if they contain any idea of any value I venture to hope that our administrators will take up that idea and carry it out to the benefit of our science and the greater glory of our congress.

REMINISCENCES OF THE EARLY DAYS OF THE PHYSIOLOGICAL CONGRESSES[1]

By Dr. LEON FREDERICQ
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THE first idea of assembling the physiologists of all countries in periodical congresses sprang from an exchange of views between Hugo Kronecker and the English physiologists who had worked with him in Ludwig's laboratory at Leipzig. At the instigation of Kronecker, the Physiological Society of London, under date of March 19, 1888, addressed to 109 professors of physiology a circular letter inviting them to consider the advantages of assembling in a congress the following year and proposing to select for the purpose the city of Berne.

As a result of this proceeding, which was received with unanimous favor, a certain number of English, French, German, Italian and Swiss physiologists gathered on September 10, 1888, with Kronecker at Berne and evolved a program of work.

It was decided that the sessions of the congress were not intended to compete with the physiological periodicals in the publication of new facts. It was strongly emphasized that the communications should be of the nature of demonstrations and devoted primarily to experimentation. To discourage those who might be tempted to read their papers at the congress, it was decided not to print the text of the communications and not officially to admit representatives of the press. This was something quite new in an international congress. It was further decided, at the suggestion of Michael Foster, that the greatest simplicity should prevail at the general meetings and that festivities, receptions and official addresses should be avoided.

As the premises of the Hallerianum at Berne were not ready at the moment, it was decided to meet at Bâle, where the new institute of anatomy and physiology, the Vesalianum, and that of physics and chemistry (Bernouillanum) would meet all the requirements of the experimentalists.

Professor Holmgren, of Upsala, was appointed president of the congress.

The first Congress of Physiology met at Bâle, the following year, from the ninth to the twelfth of September, under the direction of Miescher. It numbered 129 members. England, Germany and France had furnished the largest contingents.

The brilliant galaxy of English-speaking physiologists was represented virtually in full strength: Michael Foster, Langley, Gaskell, Gotch, Bowditch, Waller, Beevor and Horsley, Halliburton. Among the French: Chauveau, Arloing, Bouchard, Dastre, Morat, Gley, Lapicque, Doyon, Hedon, Arthur, Raphael, Dubois, Roger, Charrin. Among the Germans: Goltz, Hermann, Heidenhain, His, Fick, Preyer, Grutzner, Loeb, Rosenthal, Hering, Schiff, v. Mering, Kronecker. Among the Italians: Mosso, Fano, Albertoni. Also Holmgren, Einthoven, Prevost, Herzen, Bunge, Kocher, Blix, Tigerstedt, Heger, etc.

Few dissertations were read, but numerous experiments of the greatest interest were performed. Von Mering and Minkowski gave a demonstration of diabetes by extirpation of the pancreas. Other exhibits were Mosso's ergograph, Goltz's dog without cerebral hemispheres, Bowditch's composite photographs, Waller's electric variations of the human heart, Dastre and Morat's vasodilation by stimulation of the cervical sympathetic. The Englishmen Beevor and Horsley evoked amazement by the virtuosity of their operations demonstrating the motor functions of the cerebral cortex in the monkey.

Thus many things were seen at the congress of Bâle which can not be learned in books. Furthermore the opportunity was afforded a great many physiologists to get better acquainted. I recall seeing at Bâle the irascible Hering chatting amicably with the venerable Holmgren, whom he had assailed in anything but parliamentary language in *Pflüger's Archiv*. A moment later he was seen conversing with von Kries, who, the year before, had declared in another periodical that he refused any further discussion with the professor from Prague.

The success of the congress, then, was conspicuous. It was decided not to stop there, and that a second congress should be held, three years later, at Liége, in the new institute which had just been erected there.

The Congress of Liége (August 29–31, 1892) numbered only 102 physiologists. Cholera, which had been reported in several countries, had found some victims in Belgium, which explains the almost complete absence of German physiologists. The English and French, not afraid of the cholera, had come in larger numbers than to Bâle: 25 English, 20 French.

The traditions inaugurated at Bâle of good fellowship and monastic simplicity (the expression is Dastre's) were strictly observed at Liége. The committee had even declined an official reception at the Hôtel de Ville tendered by the municipality of Liége. Sir Michael Foster might have been seen at the inaugural session of the congress smoking his dudeen at the official table.

[1] Closing address of the International Physiological Congress, August 23, 1929.

No official reception, few festivities, but useful work. Chauveau repeated on the living horse his celebrated experiments made in common with Marey on the recording of the cardiac pulsations by means of cardiographic probes introduced into the cavities of the heart. I can still see the venerable old man of noble and imposing features, following on the wet screen the trace of the auricle and the ventricle recording themselves one below the other. All the physiology of the cardiac movements was unfolded before our eyes, interpreted with juvenile animation, each incident provoking a new digression and involving the orator in a new and brilliant improvisation. It was a historic, never-to-be-forgotten moment, the high point, so to speak, of the congress. These experiments made a deep impression upon all present and were destined to put an end to the controversies excited in Germany by the interpretation of the cardiograms and the determination of the moments of opening and closing of the valvules.

Hamburger demonstrated, in the case of red globules, suspended in saline solutions, the laws of isotomy, according to the method of de Vries. These experiments, which introduced physical chemistry to medical science, were, as you know, the starting-point of a new chapter on physiology.

Hedon produced his system of subcutaneous grafting of the stomachal portion of the pancreas, and the results of extirpating either the pancreas or the graft from the point of view of the appearance of diabetes. It is the story of insulin before the letter.

The curious phenomena of autotomy of the claws were demonstrated on living crabs. In short, it was another opportunity to admire the impeccable operating ability of the English in the person of Sherrington, who made on a female monkey the experiment of stimulating the cortical centers of the anus and the vagina.

The third congress was held at Berne, September 9–12, 1895, on the premises of the Hallerianum, presided over by Kronecker. Among the numerous experiments, let us mention only the cardiac allorythmia (His junior) by a section of auriculo-ventricular muscular sheaf, to which the name of His's sheaf has been given, the fibrillation of the ventricles by closing of the coronary arteries (Kronecker). Finally Langley expounded his new ideas on the constitution of the sympathetic nervous system, and demonstrated on a cat the effects of pre- and post-ganglionic stimulation.

The Congress of Berne, while as scientific as the two preceding, was less dry and had a social addition: a garden party at the villa of Professor Kronecker, a party given by the medical corps, with an organ recital, illumination of the cathedral and excursion to the Schynige Platte.

I shall not go so much into detail about the work done by the succeeding congresses which followed each other every three years, with success and numbers increasing steadily, so that at the Congress of Groningen in 1913, the last before the war, there were 432 participants.

At the fourth Physiological Congress, which was held at Cambridge, England, and presided over by Sir Michael Foster, the principal innovation was the printing, on loose leaves, of the text of the matters discussed, which text was distributed to all the members of the congress It was at Cambridge that, at the suggestion of Marey, an international committee for the unification and checking of recording instruments in physiology was begun. This was the origin of the Marey Institute, established at Parc des Princes at Boulogne-sur-Seine near Paris.

At Cambridge, Foster showed us an isolated fragment of a dog's heart nourished by artificial circulation of oxygenated serum under pressure, which kept beating. It was there too that Atwater demonstrated the alimentary value of alcohol, etc.

At the fifth congress, held at Turin, September 17–21, 1901, presided over by Mosso, Italian was adopted—together with English, French and German —as a fourth official language of the congress. We were given an artistic medal representing *Minerva medica,* and at the final banquet we were treated to a chamois presented by the King of Italy and killed by him expressly for us. At the session of September 17, 1901, Sir Michael Foster was made perpetual honorary president of the Congresses of Physiology.

Locke showed us an isolated rabbit's heart which continued beating for long hours, with no other nourishment than a saline solution, oxygenated and glucosed. Bayliss showed the vaso-dilating function of the posterior vertebral roots. Langley demonstrated the paralyzing influence of nicotine on the great sympathetic.

At the sixth congress, held at Brussels, August 31–September 3, 1904, presided over by Paul Heger, let us note the demonstrations of Einthoven on the string galvanometer, of Cannon on the movements of the intestines, studied by means of X-rays and reproduced by means of the zootrope, of Victor Henri on the colloids, of Lapicque on the laws of electrical stimulation, of Charles Richet on anaphylaxia, etc.

The congress decided to take under its protection the laboratory of the Col d'Olen at 3,000 meters altitude and to ask the Italian government to name it the Mosso Institute (which was granted).

The seventh congress took place at Heidelberg, presided over by A. Kossel. We note the experiments of Beshold on the mechanical separation of colloids by ultra-filtration, and the communications of Delezenne,

Foa, Gley, Cohnheim, Percy and others on digestive ferments. A plan for the classification and nomenclature of proteic matters, sponsored by the Physiological Society of London, was discussed.

The eighth congress was held at Vienna, September 27–30, 1910, presided over by Sigmund Exner. Professor Charles Richet lectured on "Ancient and Modern Humoralism." The one hundredth anniversary of the birth of Théodore Schwann, the immortal author of the cellular theory, was celebrated.

The ninth congress, the last before the war, took place at Groningen, September 2–5, 1913, presided over by Hamburger in the fine institute just inaugurated. Pavlov gave a lecture on "Experimental Study of the Superior Nervous Functions."

There was much admiration of the beautiful cinematographic views of Comandon and Bull on cardiac pulsation, capillary circulation and movements of protoplasm. Mines showed the continued circular movement in a ring of cardiac tissue, and attached thereto a tentative explanation of fibrillation, etc.

If we look backward to consider the results achieved by these nine Physiological Congresses, spreading over a period of 25 years, we may say that they give a faithful picture of the development and progress of physiology during that quarter of a century. These meetings witnessed the first fruit of nearly all the great forward steps made in our science. Thus they formed a precious means of mutual instruction for physiologists: with a minimum of time and effort they were initiated into all the new problems of the science of life, and became familiar with the most varied techniques. They afforded also an opportunity to know one another better, and to make friends with learned men of foreign lands. Alas! the war interrupted this fine tradition; fortunately we have resumed it and it is continued now in Boston, after Paris, Edinburgh and Stockholm. Let us wish good fortune to this work of progress and peace. It is in excellent hands, as the great success of the present meeting proves.

OBITUARY

RECENT DEATHS

DR. ROBERT HALL BOWEN, professor of zoology at Columbia University, died on August 19, after an operation for appendicitis. He was thirty-seven years of age.

DR. EDWARD F. BUCHNER, since 1908 professor of education at the Johns Hopkins University and director of the college for teachers, died unexpectedly of heart disease in Munich on August 23 in his sixty-first year. Dr. Buchner was professor of analytical psychology in New York University from 1896 to 1901.

WALDRON DEWITT MILLER, associate curator of ornithology of the American Museum of Natural History, has died as the result of injuries sustained in a motorcycle accident on August 4. Mr. Miller was fifty years old.

DR. JAMES DITMARS VOORHEES, a specialist in obstetrical surgery and professor of that subject at the College of Physicians and Surgeons of Columbia University, died on July 29 at the age of sixty years.

THE death is reported of Dr. Etienne Bieler, the deputy director of the Imperial Geophysical Experimental Survey of West Australia. Dr. Bieler died while awaiting the arrival of Professor A. O. Rankine, director of the department of technical optics in the Imperial College of Science and Technology, London, who had reached Perth and who intended to cooperate with him in his work.

Nature reports the deaths of M. Léon Lindet, member of the section of rural economy of the Paris Academy of Sciences, known for his work on the physiology of plant and animal foodstuffs, on June 16, aged seventy-two years; of Professor Wilhelm Ellenberger, formerly rector and director of the physiological and histological institute and of the physiological chemistry research station of the Veterinary High School, Dresden, and of Lieutenant-Colonel George Henderson, formerly of the Indian Medical Service and for a time director of the Royal Botanical Gardens and professor of botany in the University of Calcutta, on June 24, aged ninety-two years.

THE death is announced of Karl Auer, Ritter von Welsbach, the inventor of the incandescent gas light, the electric metal thread lamp and other important technical advances. He was president of the Auergesellschaft, which has large chemical works at Treibach, and member of the Academies of Sciences of Vienna, Berlin and Stockholm. The London *Times* writes: "Karl von Welsbach, who was seventy years of age, was the son of Aloys Auer, Ritter von Welsbach, for many years head of the state printing works in Vienna and himself known as an inventor of many devices in printing and paper-making. He studied in Heidelberg under Bunsen, and his researches in the chemistry of rare minerals produced several results of scientific and technical importance. His invention of the incandescent mantle was made in 1885, and five years later the company, the Auergesellschaft, which

now has 4,000 employees, was formed to manufacture the Welsbach patents. The invention by Karl von Welsbach of the osmium filament lamp followed in 1897, and six years later he invented the ferro-cerium compound used in pocket lighters. Many scientific bodies in his own country and abroad conferred their honors upon him, and he himself endowed a number of social and scientific institutions."

SCIENTIFIC EVENTS

THE BOTANIC GARDEN OF THE UNIVERSITY OF CAMBRIDGE

THE syndicate appointed last January to consider the organization and finance of the Botanic Garden and the relations between the garden and the department of botany and other scientific departments have made a report to the university. The appointment of the present syndicate was a consequence of the urgent need of the Botanic Garden for increased financial support. In response to the report on the situation made by the regular Botanic Garden syndicate, doubts were expressed in some quarters, not only as to the need for some of the existing expenditure associated with the garden, but also as to whether the garden itself was worth what it cost to the university. Such a point of view, if seriously held, demanded a very full treatment. The syndicate have held five meetings, and have interviewed both the director and the superintendent of the garden. In the result, the syndicate make the following recommendations:

(1) That the Botanic Garden should become an integral part of the department of botany.

(2) That the responsible head of the garden should be the professor of botany and that the actual director of the garden should be either the professor himself or a member of his staff, nominated by and responsible to him.

(3) That the duties of the director should be general responsibility for the management of the garden and particular care for its development as an aid to the study of botany, this work being regarded as a part-time occupation only.

(4) That the stipend attaching to the office of director should be reduced from its present value of £500 per annum in addition to a house and allowances to a value not less than £200 nor more than £300 per annum, inclusive of a house and allowances.

(5) That the stipend attaching to the office of the director should be variable according to the nature of the other offices held simultaneously by the director.

(6) That a new university lectureship should be created for the teaching of systematic botany and that the duties of the new lecturer should include as a part all teaching work hitherto performed by the director of the garden.

(7) That the office, duties and emoluments of the present superintendent of the garden should continue unchanged.

(8) That a permanent sinking-fund should be established into which an annual amount should be paid to meet normal depreciation in the glasshouses and heating services of the garden.

(9) That in addition to the annual amount referred to in the last preceding recommendation, steps should be taken to provide a capital sum of £2,000 within six years, and a further £2,000 within twelve years, to meet the cost of urgent reconstructional work.

(10) That consideration should be given by the university to the fact that a part of the land adjoining the garden could be sold under suitable restrictive conditions without detriment to the present or probable future needs of the garden.

(11) That, until appeals for benefactions for the garden can be launched and their results ascertained, the costs of the garden, beyond those which can be met by the present grant, should be met by an additional non-recurrent grant from the university chest.

(12) That consideration should be given by the university to the suggestion that the Town of Cambridge be invited to contribute to the cost of the garden, so long as it is made accessible to the general public.

(13) That the executive functions of the permanent Botanic Garden Syndicate should cease, that their duty should be periodically to inspect the garden from the point of view of amenities, and to report to the university, and that their constitution should provide for the representation of the interests of the Town of Cambridge.

DEMONSTRATIONS OF BIOLOGICAL WORK AT WOODS HOLE

FOREIGN members of the Thirteenth International Physiological Congress visited Woods Hole on Saturday after the adjournment of the Boston meeting. They were entertained at luncheon and at a clam bake in the evening. In the laboratories of the Marine Biological Laboratory and the Bureau of Fisheries the following demonstrations were arranged:

MARINE BIOLOGICAL LABORATORY

RUTH B. HOWLAND, Micro-injection of the Vacuolated Problem of the Digestion of Fats.

Cytoplasm of Actinosphaerium with Reference to the

JEAN T. HENDERSON, Micro-injection of Indicator Dyes into Fibers from the Sartorius Muscle of the Frog.

CHARLES W. METZ, Microscopic Preparations and Cultures of *Sciara* (Fungus Gnats). Slides Showing Chromosomes and Monocentric Spermatocyte Division with Selective Segregation of Chromosomes.

DOUGLAS A. MARSLAND, Micro-injection of Lipoid Solvents into *Amoeba dubia*.

FRANK FREMONT-SMITH, Charts Illustrating the Com-

position of Cerebrospinal Fluid and Serums in Elasmobranchs and in Man.

CLARENCE A. MILLS, Alternation in Visual Function of the Eye with Binocular Vision.

B. SEN, A New Type of Micro-electrode.

HENRY H. DONALDSON and MRS. W. F. GREENE, Drawings for an Anatomy of the Albino Rat.

E. NEWTON HARVEY, Luminous Animals of Woods Hole; Cypridina Luminescence.

ETHEL BROWNE HARVEY, Micro-injection of Arbacia Eggs; Microscopical Observation of Arbacia Eggs in Complete Absence of Oxygen.

ELIOT R. CLARK and ELEANOR L. CLARK, Studies on Monocytes and Macrophages in the Tail of Living Frog Larvae; Studies on Reactions of Blood-vessel Endothelium in the Tail of Living Frog Larvae.

E. R. CLARK, J. C. SANDISON and R. REX, Study of Living Cells in a Transparent Chamber Introduced into the Rabbit's Ear.

EDUARD UHLENHUTH, Methods of Studying the Physiology of the Salamander Thyroid Gland; Exhibition of American Endocrine Literature.

H. C. BRADLEY, Studies in Comparative Digestive Mechanisms; Viscosimetric Determinations of Pepsin, Trypsin, Amylase and Rennin in Marine Organisms.

P. BRANDT REHBERG, Apparatus for Determination of Carbon Dioxide in Air and Carbon Dioxide Tension in Sea Water.

LEO LOEB, Urease of Amoebocytes of Limulus; Demonstration of Amoebocyte Tissue of Limulus.

WARE CATTELL, Some Effects of the Direct Electric Current on Marine Animals and Their Eggs.

H. H. PLOUGH, Complete Developmental History of a Compound Ascidian, *Botryllus;* Living and Stained Preparations.

RUTH S. LYNCH, HELEN B. SMITH and ELSIE CLINE, Work in Progress on Genetics of Rotifera; Work in Progress on the Rodent Placenta with Special Reference to Vascularization.

M. H. JACOBS, Apparatus for Studying the Rate of Hemolysis.

HANS WINTERSTEIN, Micro-respirometer for Investigating the Metabolism of Local and Conducted Excitation.

W. J. V. OSTERHOUT, Bioelectrical Effects in Muscle and in Plant Cells.

LOUISE and MARCELLE LAPICQUE, Measurement of Chronaxie of the Mantle of *Loligo*; Modification of the Chronaxie of the Nerve by Tension on the Muscle (Frog).

D. J. EDWARDS and MCKEEN CATTELL, The Effects of Hydrostatic Pressure on the Contraction of Cardiac Muscle.

W. E. GARREY, The Heart-beat of *Limulus polyphemus;* Effects of Light on Muscle Tone in Insects.

C. G. ROGERS, Apparatus and Method for Determining the Rate of Beat of Cilia.

C. E. MCCLUNG, Preparations of Orthopteran Germ Cells.

W. H. F. ADDISON, Brains of Marine Vertebrates.

E. ELEANOR CAROTHERS, First Spermatophyte Chromosomes of a Short-horned Grasshopper, *Trimerotropis vinculata;* Preparations Illustrating the Use of Feulgen's Stain.

E. V. COWDRY and S. F. KITCHEN, Intranuclear Inclusions in Hepatic Cells Caused by the Virus of Yellow Fever.

A. FRANKLIN SHULL, Intermediates Between Gamic and Parthenogenetic Aphids.

SELIG HECHT and SIMON SHLAER, Visual Acuity at Various Intensities and Colors.

HARRY GRUNDFEST, The Rheotropic Reaction in Fishes Used for the Study of Various Photosensory Phenomena.

H. W. STUNKARD, The Complete Life Cycle of the Trematode, *Cryptocotyle lingua.*

SERGIUS MORGULIS, Methods for Bone Analysis.

JACK SCHULTZ, Eye Pigments and Eye Color Mutants in *Drosophila.*

H. MCE. KNOWER, Injected Blood-vessels and Lymphatics of Amphibian Embryos.

B. H. GRAVE, Reactions to Light of the Larvae of *Bugula flabellata;* The Swimming Ability of Spermatozoa; Method of Rearing Larvae to Metamorphosis upon Diatoms; Longevity of Unfertilized Gametes of *Hydroidea.*

MARGARET SUMWALT, Measurement of Potential Differences Across the Chorion of Single *Fundulus* Eggs.

ABBY H. TURNER, Studies by Tilting-table and Other Methods of the Effect of Gravity on the Human Circulation.

WALTER S. ROOT and CHARLOTTE HAYWOOD, The Effect of Carbon Dioxide upon the Oxygen Consumption and the Rate of Cleavage of Fertilized *Arbacia* Eggs.

L. MICHAELIS, Apparatus for Purification of Nitrogen from Traces of Oxygen and Measurement of a Reduction Potential.

E. S. G. BARRON, Respiration of Unfertilized Sea-urchin Eggs and its Increase by Methylene Blue as Measured with Warburg's Micro-respiration Apparatus.

PRISCILLA FREW, Living Specimens of *Lebistes reticulatus.*

JOSE F. NONIDEZ, Microscopic Slides Showing Vascular Innervation of the Thyroid Gland (Method of Golgi).

ANNA K. KELTCH, Specific Sperm Agglutinin (Lillie's Fertilizin).

T. H. MORGAN, Cultures and Mutant Types of *Drosophila.*

LORANDE LOSS WOODRUFF, Pedigree Cultures of Various Species of *Paramecium* Including *Paramecium aurelia* at 13,500 Generations (22 years).

C. B. BRIDGES, Chromosome Groups of *Drosophila.*

SAMUEL GELFAN, Microdissection Studies.

RALPH S. LILLIE, Activation, Transmission, Interference and Recovery in Passive Iron Wires.

ROBERT CHAMBERS, Microdissection Studies (Acid-Basic and Oxidation-Reduction Potentials).

C. C. SPEIDEL, The Production and Proliferation of Young Thrombocytes and Erythrocytes in the General Circulation of Splenectomized Salamanders. (Blood-smear Preparations and Drawings.)

JAMES E. KINDRED, Slides Showing Changes in the Kidney of the White Rat Following Ligation of the Major Blood Vessels.

L. V. HEILBRUNN, The Measurement of Protoplasmic Viscosity; The Surface Precipitation Reaction.

GARY N. CALKINS, Non-individuality of Chromosomes in *Uroleptus Halseyi.*

R. BOWLING, Conjugation of Distomatous Forms of *Glaucoma scintillans.*

E. G. CONKLIN, Effects of Low Temperatures on Segmenting Eggs of *Crepidula;* Effects of Centrifugal Force on Development of Ascidian Eggs.

A. H. STURTEVANT, Corresponding Mutant Types in *Drosophila melanogaster* and *D. simulans.*

W. DOBZHANSKY, Chromosomes of *Drosophila melanogaster* Involved in a Translocation.

MANTON COPELAND, Behavior of *Nereis:* Method of Keeping Worms; Methods of Inducing Conditioned Responses; Behavior of Worm without Brain.

MARIE A. HINRICHS and IDA GENTHER, Ultra-violet radiation and Modification of Development in *Fundulus* and *Arbacia* and Rate of Heart Beat in *Fundulus.*

MARGARET R. MURRAY, Cultivation of Planarian Tissues in vitro.

WM. L. DOLLEY, JR., Various Stages in the Life History of the Drone Fly, *Eristalis tenax;* Apparatus Used in the Study of the Effect of Intermittent Light upon the Eye of the *Eristalis tenax* and in the Study of Adaptation in the Eye of *Eristalis.*

PAUL REZNIKOFF, Micrurgical Technique.

KENNETH BLANCHARD, Chemical Composition of *Arbacia* Eggs.

J. MAYOR, Certain Effects of Alternating Currents of Extremely High Frequency (1.5 Meters Wavelength).

HENRY J. FRY, Cytological Preparations of the Mitotic Mechanism in *Echinarachnius* Eggs.

STAFF and STUDENTS OF THE COURSE IN INVERTEBRATE ZOOLOGY, Living Invertebrates of the Woods Hole Region.

IVON R. TAYLOR, Measurement of Oxygen Consumption of Individual Pupae.

N. A. COBB and J. R. CHRISTIE, Living Mermithid Parasites as a Controlling Factor in the Birth-rate and Sex of Certain Grasshoppers; (Alive) Marine Free-living Nemas; Microscope Installation on Masonry, Specially Adapted Among Other Things for Camera Lucida Drawings; Birefringents of Living Cells.

P. W. WHITING and STUDENTS; ANNA R. WHITING, Genetic Work on the Parasitic Wasp, *Habrobracon juglandis;* Mutant Types and Methods of Rearing.

LORNA W. THIGPEN, Microscopic Demonstrations of Skins of Hairless Mammals.

E. ALFRED WOLF and PAUL HENSHAW, Effects of Alpha Rays on the Development of *Arbacia* Eggs.

STAFF OF THE BOTANY COURSE, Selections of Living Marine Algae from the Woods Hole Region.

W. M. SHANKLIN, Specimens of Brains from Various Fishes.

E. B. KRUMBHAAR, Stained Blood Smears of 200 Varieties of Fishes.

ARTHUR W. POLLISTER, Slides Showing Cytoplasmic Phenomena During Mitosis in Pancreas Cells of the Dogfish.

BUREAU OF FISHERIES LABORATORY

O. E. SETTE, R. A. NESBIT, E. W. BAILEY, Biology of mackerel.

PAUL S. GALTSOFF, Physiology of *Lamellibranchiata.*

C. E. CUMMINGS, Models of Local Fishes Showing Adaptations.

N. A. COBB, Microscopic Installation; Birefringence in living cells.

KENDALL W. FOSTER, The Use of the Silverman illuminator in the Direct Illumination of the Skin of the Fish, *Fundulus heteroclitus,* Showing the Chromatophores and especially the Iridocytes and Reflecting Layer.

PAUL S. CONGER, Diatoms.

JOHN C. HEMMETER, Microscopic Structure of Isolated Langerhans Organ of *Lophius* by Microprojectoscope.

R. A. NESBIT, Biology of Middle Atlantic fishes.

F. G. HALL, I. E. GRAY, R. W. ROOT, L. C. CHESLEY, Respiration of Marine Fishes.

INTERNATIONAL LIGHTHOUSE CONFERENCE

THE first International Lighthouse Conference that has ever been held met in London in July on the invitation of Trinity House, the English lighthouse authority. Trinity House is an organization with a long record of high achievement in the lighthouse work of the world. It holds a charter granted in 1514, and it has carried out some of the most important lighthouse engineering works, such as the building of the lighthouses on Eddystone Rock and Bishop Rock. It has included among its engineers Smeaton and Douglas, and on the governing board, known as the Elder Brethren of Trinity House, have been many of the noted men of England.

The conference included representatives of the lighthouse authorities of twenty-four countries, and also of a number of local lighthouse organizations and interested industries. The conference was entirely informal, and its purpose was the exchange of information and the discussion of problems affecting lighthouse systems; it did not undertake to pass final judgment on any matter. The conference was opened under the presidency of the master of Trinity House, the Duke of Connaught, and the chairman of its meetings was Admiral Mansell, the deputy master. Sessions were held from July 8 to July 12, and during the following week inspection trips were made to various works. The principal topics of discussion were lighthouse illuminants, unattended lighting systems, aerial lights, floating aids to navigation, including lightships and buoys, lighthouse structures, fog signals, radio beacons and other related matters. Much interesting information was presented, both in formal papers submitted in advance, and in discussion at the conference. The proceedings will be published by

Trinity House. The representatives of the United States were: George R. Putnam, commissioner of lighthouses, Washington; J. T. Yates, superintendent of the Third Lighthouse District, New York, and H. W. Rhodes, superintendent of the Eighteenth Lighthouse District, San Francisco, all of the Department of Commerce.

THE MATHEMATICS OF ENGINEERING

THE American Mathematical Society, at its annual meeting to be held at Lehigh University, Bethlehem, Pa., from December 27 to 28, is arranging that Friday be given to the presentation of the usual type of papers and that Saturday be devoted to a symposium on the mathematics of engineering. The general topic chosen for the Saturday sessions is "Differential Equations of Engineering," and it is proposed tentatively that both morning and afternoon three half-hour papers be given by men eminent in their fields. This part of the program is being arranged because of a wish expressed by some members of each of the two groups—mathematicians and research engineers—for closer cooperation.

All who are interested are cordially invited to attend. Headquarters for the meeting are at the excellent Hotel Bethlehem. Further details are being planned by the committee on arrangements, of which Professor Tomlinson Fort, of Lehigh University, is chairman. The sessions will be held in the new Packard Laboratory for electrical and mechanical engineering, a building which sets a new standard for equipment for teaching and research in engineering. On request to the secretary of the American Mathematical Society, 501 W. 116th Street, New York City, a printed program will be sent when it is off the press (about December 7). Other information will be gladly furnished.

All of the persons invited to participate in the program have accepted and have tentatively submitted titles.

H. W. March, department of mathematics, University of Wisconsin.

Vannevar Bush, department of electrical engineering, Massachusetts Institute of Technology.

T. H. Gronwall, department of physics, Columbia University.

A. Nadai, Research Laboratory, Westinghouse Electric and Manufacturing Company. (Formerly of the University of Göttingen.)

R. H. Park, Engineering Department, General Electric Company.

S. Timoshenko, department of mathematics, University of Michigan. (Formerly with the Westinghouse Electric and Manufacturing Company.)

R. G. D. RICHARDSON,
Secretary of the American Mathematical Society

SCIENTIFIC NOTES AND NEWS

PAINTINGS of scenes and persons identified with the history of Columbia University will be presented to the institution by alumni and various civic, historical and ecclesiastical societies, as part of the ceremonies to mark the celebration of its one hundred and seventy-fifth anniversary, which will take place from October 25 to 31. The portraits include among members of the faculties Dr. Michael I. Pupin, professor of electromechanics; Dr. John Dewey, professor of philosophy, and Dr. Henry Fairfield Osborn, research professor of zoology. Among the portraits of those who have died is that of James F. Kemp, formerly professor of geology.

HONORARY degrees conferred on the occasion of the celebration of the hundredth anniversary of the Royal Danish Engineering College on August 30 include three residents of the United States. These are Professor William Hovgaard, the Massachusetts Institute of Technology; Henrik J. Krebs, founder of the dye works at Wilmington, Delaware, and Professor H. M. Westergaard, University of Illinois.

DR. JOHN A. KOLMER, professor of pathology and bacteriology in the graduate school of medicine of the University of Pennsylvania, was recently awarded the Mendel medal by Villa Nova College for his work in immunology. This is the first award of the medal, which was established to commemorate the work of Gregor Mendel.

WE learn from *Popular Astronomy* that the Committee on Astronautics of the Astronomical Society of France awarded its first annual international prize to Hermann Oberth, a German teaching at the College of Medinsch, Roumania. The presentation ceremonies were held at the Sorbonne on June 6. Walter Hohmann, a German engineer, and Noel Deisch, an American biologist, were given honorable mention. Oberth's paper was deemed of such unusual merit that the original prize of 5,000 francs was raised to 10,000 francs by the founders, Mr. Robert Esnault-Pelterie, a French aeronautic engineer, and Mr. Andre Hirsch, a French banker interested in astronomy.

CHARLES PIEÉZ, consulting engineer of Chicago, formerly vice-president and general manager of the U. S. Shipping Board Emergency Fleet Corporation, has been nominated for the presidency of the American Society of Mechanical Engineers. Vice-

presidents have been nominated as follows: Paul Doty, St. Paul, Minn.; Ralph E. Flanders, Springfield, Vt.; Ernest L. Jahncke, Washington, D. C.; Conrad N. Lauer, Philadelphia, Pa. The managers nominated are: Harold V. Coes, New York, N. Y.; James D. Cunningham, Chicago; Clarence F. Hirshfeld, Detroit.

DR. WILLIAM BOWIE, chief of the division of geodesy of the U. S. Coast and Geodetic Survey, and Commander N. H. Heck, chief of the division of terrestrial magnetism and seismology, have been elected alumni members of the Sigma Xi chapter at Lehigh University.

THE Cameron prize in practical therapeutics of the University of Edinburgh has been awarded to Sir Leonard Rogers, in recognition of the discoveries he has made in the treatment of several tropical diseases and in particular in the treatment of cholera, amoebic dysentery and leprosy.

PROFESSOR J. J. R. MACLEOD, regius professor of physiology in the University of Aberdeen, and Mr. Wilfred Trotter, honorary surgeon to the King of England and surgeon to University College Hospital, London, have been appointed members of the British Medical Research Council, in succession to Professor E. P. Cathcart and Sir Charles Sherrington, who will retire in rotation on September 30.

REPRESENTATIVE LUCE (Republican), of Waltham, Massachusetts, has been appointed a member of the board of regents of the Smithsonian Institution by Speaker Longworth. He succeeds Representative Newton, of Minneapolis, whose resignation as a member of the House became effective on June 30.

COLONEL CLARENCE M. YOUNG, of Des Moines, Iowa, until now director of the aeronautics branch of the Department of Commerce, has been appointed assistant secretary of commerce for aeronautics, succeeding William P. MacCracken, Jr., who has resigned to engage in the practice of law.

DR. FREDERICK EBERSON, assistant professor of medicine of the University of California, has recently been appointed director of the clinical and research laboratories at the Mount Zion Hospital, San Francisco.

PRESIDENT W. O. HOTCHKISS, of the Michigan College of Mining and Technology, has been appointed chairman of the committee on mining and metallurgy for the Society for the Promotion of Engineering Education. The other members of the committee are: R. M. Black, University of Pittsburgh; R. S. McCaffery, University of Wisconsin; W. G. McBride, McGill University; C. M. Young, University of Kansas; Joseph Daniels, University of Washington, and H. E. Nold, Ohio State University.

H. L. SEWARD, professor of mechanical and marine engineering in the Sheffield Scientific School at Yale University, has been appointed to assist Charles A. McAlister, the president of the American Bureau of Shipping. By an arrangement with Yale University, Professor Seward will devote only part time to his work at the university.

PROFESSOR ALFRED LANDÉ, professor of theoretical physics at the University of Tübingen, Germany, has been elected visiting professor of theoretical physics at the Ohio State University for the autumn and winter quarters of the academic year 1929–30, and Dr. L. H. Thomas, of Trinity College, Cambridge, England, has been elected assistant professor of theoretical physics. He will be in residence for the entire academic year 1929–30.

THE completion of the first year of Dr. Shirley W. Wynne's incumbency as New York City Health Commissioner was marked on August 16 by a surprise reception attended by the heads and personnel of all the bureaus under his supervision in his offices in the health department. Each bureau gave the commissioner a basket of roses or gladioli, and he received numerous telegrams of congratulation and commendation. Dr. Thomas Darlington, who was the commissioner of health from 1904 to 1910 and who appointed Dr. Wynne twenty-two years ago to the position of medical inspector, greeted the commissioner upon his entrance to his office and complimented him on the accomplishments of the past year in the Department of Health.

DR. B. SMITH HOPKINS, professor of inorganic chemistry at the University of Illinois, has been granted a leave of absence for the academic year 1929–30. He will spend the time on the Pacific coast studying methods of research, teaching and manufacturing.

DR. E. L. OVERHOLSER, of the division of pomology of the University of California, will sail on September 12 on a trip to the Orient to study problems of the marine refrigeration of perishable products. He will return at the end of December.

DR. CHIA CHI WANG, who was a guest in The Wistar Institute Laboratory during the years 1925 to 1927, is returning to China to take up a teaching position in the department of biology at the National Central University, Nanking, China.

C. L. LUNDELL, assistant physiologist of the Tropical Plant Research Foundation and a student in the department of botany of Columbia University, sailed from New Orleans on August 9 for British Honduras, where he will assist Dr. J. S. Karling in the investigation of problems involved in the production of chicle. This work, which is being carried out at

Honey Camp by the Foundation for the Chicle Development Company of New York, is now in its third year.

ARTHUR LOVERIDGE, assistant curator of reptiles and amphibians at the Museum of Comparative Anatomy of Harvard University, will leave next month for the African jungles to make collections of reptiles for the museum. Mr. Loveridge will center his activities in the neighborhood of the Livingstone Mountains, about 300 miles south of the spot where Stanley and Livingstone met, where he expects to find traces of animal life which show connections, with both the country further north and the fauna of South Africa. In addition to the collection of reptiles and amphibians, he will endeavor to gather information concerning their life histories, foes and parasites. Mr. Loveridge expects to return to the United States in the summer of 1930.

EXERCISES for the dedication of the Wilmer Ophthalmological Institute will be held on October 15 and 16, under the auspices of the Johns Hopkins University, the Johns Hopkins Hospital and the William Holland Wilmer Foundation. An appropriate program has been arranged including the following addresses: "The Development of Ophthalmology in Europe," by Hofrath Ernst Fuchs, of the University of Vienna; "Some Contributions and Phases of American Ophthalmology," by Dr. George E. de Schweinitz, of the University of Pennsylvania, and "Color Vision and its Anomalies," by Sir John Herbert Parsons, of the University of London.

IN the recent symposium on chemical kinetics at the University of Minnesota, the lecturers included: Dr. M. Polanyi, of Berlin; Professor H. S. Taylor, head of the department of chemistry at Princeton University; Professor Samuel C. Lind, head of the school of chemistry of the University of Minnesota; Professor Farrington Daniels, of the University of Wisconsin, and Drs. R. S. Livingston and L. H. Reyerson, of the University of Minnesota.

THE hundred and tenth annual meeting of the Swiss Scientific Association is being held at Davos from August 29 to September 1, under the presidency of Dr. W. Schibler.

THE second International Malaria Congress will be held at Algiers on May 19, 20 and 21, 1930, under the presidency of E. Marchoux. There will be six sections: biology of the parasite of malaria; biology of the mosquito; epidemiology; pathology; therapeutics, and prophylaxis. There will be excursions to interesting points, such as la Mitidja, Constantine and Laveran. Requests for registration must be accompanied by 100 francs; a certificate entitles the holder to all privileges.

SIR THOMAS HOLLAND, president of the British Association, who has returned to Johannesburg from Rhodesia, in the course of a statement regarding the results of the association's meeting, is reported in the London *Times* to have said: "Speaking from my own experience, and I have attended meetings of the British Association in Australia and Canada, I should say that our meeting in South Africa has been one of the most successful oversea meetings we have had. We have had, among other things, very good local papers by local workers, which have led to very useful discussions. In addition to that everybody to whom I have spoken have been very much impressed by the kindness of the local people, from whom they have learned something new about the conditions and problems of the country. I have noticed the very keen interest of the people attending the public lectures and discussions, and that to me has been an unusual thing. Previously I have often seen people at lectures drift away, but here in South Africa one has not seen people leave the building until the discussion has been absolutely finished. They have listened with intense interest, not as ordinary members of the public, curious to see or hear something new, but as real students. It was exactly the same in Cape Town and Johannesburg, and I have heard similar observations from Pretoria regarding the remarkable success of the agricultural section of the association there."

A CABLE from Melbourne, Australia, states that the government has accepted an offer of £20,000 by Mr. F. D. McMaster, of New South Wales, to enable the scientific and industrial research department to erect an animal health laboratory, which the government will staff and equip.

MR. ATMORE, minister of scientific and industrial research, announces that the New Zealand government has decided to take part in the scheme of Imperial agricultural research bureaus, the establishment of which was recommended by an Imperial agricultural research conference. This provides for the establishment of eight bureaus for the collection and interchange of information in eight branches of agricultural science. The bureaus, which are to be attached to recognized research institutes, will be financed from a common fund formed by contributions from governments of the empire. Several of the bureaus have already been opened, and it was hoped to open the others during the summer.

IN order to centralize and arrange a methodical plan for the scientific work which is carried on in northern Norway, Svalbard, Jan Mayen and the Arctic Sea, a Central Committee for the Scientific Institutions at Tromsö has been recently constituted, the statutes for which have now been sanctioned by the

Department of Education. According to Northern News Service, the Geophysical Institute at Tromsö will act as a weather-forecasting and aurora observatory, and Professor Krogness will have the assistance of Professor Vegard and of other scientific men working in the north, including Mr. Soot-Ryen, who has made valuable researches into the fauna of the coasts of northern Norway. The committee's aim is to forward cooperative work between the different scientific institutions of Tromsö and the north.

UNIVERSITY AND EDUCATIONAL NOTES

A CONTRACT with representatives of the Italian government has been signed by Mr. George Eastman by which he has agreed to build and equip a dental dispensary in Rome to cost $1,000,000. It will be similar to the Rochester Dispensary and the Eastman Dental Clinic of London.

W. W. COOK, of New York City, has made a gift of $200,000 to the University of Michigan for the support of lectures on American institutions.

DR. ALLEN K. KRAUSE, formerly associate professor of medicine at the Johns Hopkins University, who has recently been made director of the Desert Sanatorium and Institute for Research, has been appointed clinical professor of medicine at Stanford University. While Dr. Krause will make his headquarters at Tucson, Arizona, he will be in San Francisco at certain times during the year to participate in the teaching at Stanford.

QUENTIN D. SINGEWALD, assistant professor of geology at the Colorado School of Mines, has been appointed assistant professor of geology at the University of Rochester.

DR. KARL E. MASON has been promoted to an assistant professorship of anatomy at Vanderbilt University.

SEVERAL new instructors will join the faculty of the Pennsylvania State College next fall to work in connection with the legislative appropriation of $50,000 for oil and gas research at the college, to teach a new course in oil and gas production and to assist in teacher-training work throughout the state. These include Clark F. Barb, of the Colorado School of Mines, appointed associate professor of petroleum research, and M. R. Fenskee, of the Massachusetts Institute of Technology, who will become assistant professor in chemical engineering; Paul G. Shelley, of the University of Oklahoma, and E. F. Williams, graduate assistant in mineralogy, and Herbert J. Stack, of Columbia University.

THE following appointments that have recently been made in foreign faculties of medicine are recorded in *The British Medical Journal:* Dr. Marcel Labbé, professor of general pathology and therapeutics at Paris, has succeeded the late Professor Widal in the chair of clinical medicine; Dr. M. Wertheimer, of Berlin, has succeeded Professor Schumann in the chair of psychology at Frankfurt; Dr. Hermann Siemens, of Munich, has been appointed professor of dermatology at Leyden, and Professor Steurer has succeeded Professor Körner as director of the oto-rhinolaryngological clinic at Rostock.

H. T. TIZARD, permanent secretary of the Department of Scientific and Industrial Research, has been appointed rector of the Imperial College of Science and Technology as from the beginning of September in succession to Sir Thomas Holland, who has been appointed principal of the University of Edinburgh.

DISCUSSION

SHALER ON THE FOSSIL BRACHIOPODS OF THE OHIO VALLEY

IN the *Memoirs* of the Kentucky Geological Survey, Vol. I, there is a paper by the late N. S. Shaler, "On the Fossil Brachiopods of the Ohio Valley." This paper consists of p. [2] I–IV, 3–44, Plates I–VII, with descriptions facing the plates. The date and place of publication are not given on the title-page of this paper in the volume, but an author's separate on cover and title-page bears the name of the University Press, Cambridge, and the date 1876. Shaler's text consists of a general account of certain brachiopods of the region. The last twenty-one pages are made up of tables with very detailed measurements as prepared by A. R. Crandall. The bearing of these measurements is not obvious. The tables and illustrations are only briefly mentioned (p. II, III, 12) in Shaler's text. On page 10 are recorded *"Platystrophia lynx* n. sp., *Plectambonites sericea* n. sp." It is not clear why these should be listed as new species. One was described by Eichwald, in 1830, as *Terebratula lynx,* and later by him, 1840, referred to *Spirifer lynx.* The other was described by Sowerby, in 1839, as *Leptaena sericea.*

N. S. Shaler was at that time (1876) director of the Kentucky Geological Survey and for a long term of years professor of paleontology in Harvard University. The brachiopod paper here considered was Shaler's principal contribution to paleontology. He, however, published: 1865, "List of Brachiopoda from the Island of Anticosti Sent by the Museum in Exchange," 10 pp.; 1888, with August F. Foerste, "Pre-

liminary Description of North Attleborough Fossils," 15 pp., 2 pl., and 1889, "On the Occurrence of Fossils of the Cretaceous Age on the Island of Martha's Vineyard," 9 pp., 1 pl. Shaler's main publications were on geology or various literary subjects.

The object of this note is to call attention to a curious bibliographical occurrence in certain copies of the Brachiopod memoir cited. In eight copies examined, including two author's separates, there are seven plates, which is the number stated on the title-page. The same number exist in a copy in the library of the U. S. Geological Survey, as I am informed by the librarian, Miss Julia L. V. McCord. Again, seven plates are recorded by Dr. Willard Rouse Jillson in his bibliography of publications of the Kentucky Geological Survey as given in his "Geological Research in Kentucky," *Kentucky Geol. Surv.*, series 6, 15: 45 and 138, 1923.

In the geological library of the British Museum a copy of this memoir has eight plates, the eighth numbered VIII, but without a description. In a recent visit at the British Museum I saw this copy and told my friend, Charles Davies Sherborn, Esq., that I would try to get him information about this eighth plate. Dr. Willard Rouse Jillson, director of the Kentucky Geological Survey, writes me that their copy has an eighth plate, without description. Miss Julia L. V. McCord, noted above, kindly interested herself and wrote me that Dr. E. O. Ulrich, of the U. S. Geological Survey, possesses a copy of this paper in which also there is an eighth plate. She kindly sent me two photographs of this plate, one of which has been sent to the British Museum and the other placed in the library of the Museum of Comparative Zoology, in Cambridge. The eighth plate bears the title: "Ky. Geol. Survey. Plate VIII," and at the bottom: "E. Bierstadt's Albertype, New York." This title is in the similar extra plate in the British Museum copy, and in the other plates of the paper. In fact, Mr. Sherborn writes me that the photograph sent him "is precisely the same" as the plate in their copy. On this Plate VIII are shown twenty-five figures of the interior of the valves of *Orthis occidentalis* Hall = *Hebertella occidentalis* (Hall).

What is the meaning of this extra eighth plate in the three copies noted? I think that without reasonable doubt it is the first plate of a proposed Part II of Shaler's paper, "On the Fossil Brachiopods of the Ohio Valley," which plate must have been printed and was inadvertently bound in with the plates from Shaler's paper from Vol. I. It should be noted that this paper, in Vol. I, is not recorded as Part I. An announcement of a "Part II" was published as recorded in the following, but the paper never appeared. Miss McCord wrote me that Dr. R. S. Bassler thinks the view expressed in regard to this extra Plate VIII is probably correct, and I am glad to have his confirmatory opinion.

In the Preface of Vol. I of the *Memoirs* of the Kentucky Geol. Surv., p. iv, it is stated:

> The second volume will contain memoirs concerning the following subjects:
>
> I. "On the Prehistoric Remains of Kentucky." Part II. By Lucian [Lucien] Carr and N. S. Shaler. Map and Plates.
>
> II. "On the Fossil Corals of Kentucky." Part I. [By] N. S. Shaler.
>
> III. "On the Cavern Animals of Kentucky." By A. S. Packard, F. A. [F. G.] Sanborn, and others. 4 Plates.
>
> IV. "On the Fossil Brachiopods of the Ohio Valley," Part II. By N. S. Shaler. Maps, 8 Plates.
>
> V. "On the Cavern-Dwelling Races of Kentucky." By F. W. Putnam. 6 Plates.
>
> VI. "History of the Investigation of Cavern Animals." By H. A. Hagen.
>
> VII. "On the Dynamic Geology of Kentucky." By N. S. Shaler. Maps and Plates.
>
> The second volume is to be issued in 1877.

Of the second volume of *Memoirs* of the Kentucky Survey a paper was published entitled "The Mounds of the Mississippi Valley Historically Considered," by Lucien Carr [1883, pp. 1–107, no illustrations]. No date or number is given on the title-page of this paper, but a copy in the library of the Museum of Comparative Zoology is dated as received, September 25, 1883. In Dr. Jillson's bibliography noted above, p. 55, he refers to this paper of Lucien Carr's as "Part I" of Vol. II. He is evidently doubtful of the date of publication, for he says: "Latest referenee given is 1881," which occurs on page 106. A more definite evidence of the date of publication of this paper of Mr. Carr's is the fact that it was republished in the Annual Report of the Board of Regents of the Smithsonian Institution to July, 1891, Washington, 1893. In this publication, page 503, it records the paper on the "Mounds of the Mississippi Valley" as from *Mem. Kentucky Geol. Surv.*, Vol. II, 1883. This may be accepted as a definite date of publication.

Dr. Jillson in his bibliography, page 55, says of Vol. II of the *Memoirs* of the Kentucky Survey that it was never completed, and he records no other paper than that of Lucien Carr's above considered. Jillson further says that various titles have been ascribed to it, but without any real authority.

In the libraries of the Museum of Comparative Zoology, the Boston Society of Natural History and the British Museum, however, there is a second paper that was published in Vol. II of the Kentucky Survey. The title-page of this paper reads: "Memoirs Geological Survey of Kentucky. N. S. Shaler, Di-

rector, Vol. II, Part VIII. On the Collection of Cavern Insects. By Elzéar Abeille de Perrin, University Press, Cambridge, 1877." This apparently rare paper consists of pages 1 to 14, without illustrations. Though numbered VIII, it was evidently published, 1877, before Lucien Carr's paper, which Jillson calls number I, but which was not published until 1883.

These two papers, Lucien Carr's, No. I, and Abeille de Perrin's, No. VIII, as far as I can ascertain, were the only ones ever published in Vol. II of the *Memoirs* of the Kentucky Survey. The same conclusion is expressed by Adelaide R. Haase, on page 305 of "Index of Economic Material in Documents of the States of the United States," Kentucky, 1792–1904, Publication 85, Carnegie Institution of Washington, 1910. I would further say that apparently none of the seven papers announced for Vol. II of the Kentucky Survey as above listed was ever published, at least as there recorded.

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IONS AND ELECTRICAL CURRENTS IN THE UPPER ATMOSPHERE

In a paper to be communicated to the American Physical Society it is assumed that the ionization in the upper atmosphere is caused by the ultra-violet light of the sun and that the ion and electron densities at noon at the equator are those required by the theory of wireless wave propagation. From the laws of recombination of the ions and the diffusion and drift of the ions in the earth's magnetic and gravitational fields the distribution of the ions over the earth is worked out. This distribution turns out to be that required by the diamagnetic theory of the solar diurnal variation of the earth's magnetism. The gravitational drift currents are found to flow mainly along the parallels of latitude in the following way: on the daylight hemisphere (1) a current sheet flowing eastward in the levels above 150 km which at the sunrise and sunset longitudes divides into two sheets; (2) one of these flows westward on the day side of the earth underneath (1) in the levels below 150 km, and (3) the other sheet continues eastward in the upper levels around on the night side of the earth. The current is mainly between the fortieth parallels of latitude, north and south, and falls to lower values at the higher latitudes. The total currents in the three sheets are about 10^7, 8×10^6 and 2×10^6 amperes, respectively. The east and west daytime current sheets subtract from each other leaving in effect an eastward current of about 2×10^6 amperes flowing around the earth all the time. This causes a magnetic field agreeing in magnitude and type with that obtained by Bauer in his 1922 analysis of the magnetic field of the earth of external origin.

As a result of the drift currents, the sunset longitude of the earth is at a potential of several hundred volts above that of the sunrise longitude. This electric field combined with the earth's magnetic field causes the ions and electrons on the night side of the earth to drift upward with velocities of order 10^2 cm sec^{-1}. The ions and electrons move into regions of lower pressure and therefore do not recombine as fast as they otherwise would. This removes a difficulty from an earlier calculation which yielded too great a night-time rate of disappearance of the free charges. The upward drift of the ionization causes a rise of the Kennelly-Heaviside layer which is, partially at least, compensated by the fall due to the cooling and contraction of the atmosphere at night, and is complicated by the diffusion of the ions. It is difficult to say how much of the night-time rise of the layer observed in experiments with wireless rays may be genuine rise and how much may be an apparent rise due to delayed group velocities, or to other causes.

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MUYBRIDGE ANIMAL PICTURES

Probably there are a good many individuals who for historic, scientific or for artistic purposes would be glad to secure samples of the Muybridge Locomotion Plates published under the auspices of the University of Pennsylvania in 1887. The complete work comprised 781 plates; each plate contains from twelve to thirty-six individual pictures, that is, from one to three series representing as many different photographic angles. A series represents some act of motor coordination, such as taking a step, jumping, striking with a hammer, etc. Recently the writer discovered that the remainders of these plates are in the hands of the Commercial Museum, 34th Street, Philadelphia. Not all the plates are represented in these remainders, but probably there are copies of some 350 or 400 of the subjects. These include men, women and children, nude and draped, and a very large animal series. In the latter the action portrayed is usually that of locomotion. The plates are in excellent condition, having remained in their original wrappers during the forty years of storage. On these plates the pictures are larger and present more detail than in the bound volumes of pictures which were issued by Muybridge. The Muybridge plates are still preeminent in the field which they cover and are of great value for their faithful representation of both

men and animals in the process of carrying out representative actions.

It was while investigating the joint original work of Leland Stanford and Eadweard Muybridge on animal locomotion carried out at Palo Alto in 1878 and 1879 that the writer discovered this wealth of material in the Commercial Museum. He is glad to pass on the information. These duplicate plates should be in the possession of scientists, artists and art schools and those interested in the history of motion pictures. Those desirous of securing them should correspond with Charles R. Toothaker, Curator.

WALTER R. MILES

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A UNIFIED SYSTEM OF PRESENTING BIBLIOGRAPHIES

IN reading current scientific literature the diversity of bibliographic systems is forcibly brought to one's attention. It would seem that a more uniform and improved system of presenting bibliographies formulated through cooperation of the various scientific journals would be desirable.

A well-selected bibliography is one of the more valuable parts of a majority of scientific articles. To be of the most value to the research worker the references should enable him to trace further information on the particular point in which he is interested with the least expenditure of effort. This calls for a full presentation, including the title of the papers to which reference is made. It also calls for information as to the time when the work referred to was done, and this can be most efficiently supplied in the text of the article being reviewed.

The name-number and name-date systems of referring to bibliographies are both used. It would seem that the advantages of the name-date system justify its use in practically all cases. Its value in keeping before the reader the date of the work referred to in the text and the relation of this to its significance is evident to research men. It is an economy of the readers' time, in a great number of instances preventing the necessity of thumbing back to the bibliography. A number associated with the author's name has no value except in helping locate the reference in the bibliography. This number is different for each different bibliography. A supplementary value of the name-date system is apparent to authors when they wish to add a reference or two to a manuscript which was thought to be ready for publication. This is a frequent occurrence.

The name-date system also logically calls for the grouping of the bibliography in alphabetical order at the end of the article, which has its advantages especially in relocating references. Below are examples, referred to as Bailey and Sherwood (1926), Gortner and Holm (1920), and Mitchell (1924), which include the advantages mentioned above.

Bailey, C. H., and Sherwood, R. C.
1926 Relation of crude protein content of flour to loaf volume.
Cereal Chem. 3: 393–402.

Gortner, R. A., and Holm, G. E.
1920 The origin of the humin formed by the acid hydrolysis of proteins, V.
J. Am. Chem. Soc. 42: 821–7.

Mitchell, H. H.
1924 A method of determining the biological value of protein.
J. Biol. Chem. 58: 873–903.

It will be noted that each of the four items, date, name, title, reference, has the same definite location in each of the references. Locating the reference to the journal itself on a new line in every case is a distinct advantage to the reader and in a large number of cases requires no additional journal space. This same form of noting bibliographic references is also convenient for card index files. Arabic rather than Roman numerals for indicating the volume numbers of journals are very much preferred, since the former are always comprehended at a glance.

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A NEW BLUE CRAYFISH

WHILE traveling through the state of West Virginia during the summer of 1928 with the West Virginia University biological expedition, I collected several specimens of a blue crayfish identified by Dr. Waldo L. Schmitt, curator of marine invertebrates, U. S. National Museum, Washington, D. C., as a blue phase of *Cambarus carolinus dubius* Faxon. The only blue Cambarus hitherto recorded is *Cambarus carolinus monongalensis* Ortman collected by Dr. E. A. Ortman in Pennsylvania and the northern part of West Virginia. The altitude of this subspecies ranges from 800 to 1,200 feet.

My collections of the blue phase of *Cambarus carolinus dubius* Faxon were made from the bank beside Cool Run near Cass, Pocahontas County, West Virginia, at an elevation of 2,400 feet, and Bald Knob, located about two miles from Cass, at an altitude of approximately 3,500 feet. One blue specimen was observed at Spruce Knob, Pendleton County, West Virginia, at the elevation of 4,500 feet.

This blue crayfish will be discussed more fully in a later paper.

CURTIS L. NEWCOMBE

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QUOTATIONS

ELECTRICAL RESEARCH

A LITTLE more than a year ago attention was drawn to the financial difficulties by which the research association established in 1920 by the electrical and allied industries of this country was being faced both in insuring the maintenance of the income, about £25,000 a year, needed to enable it to continue its work on the existing scale, and still more in securing the additional money that would permit it to extend its operations. One of the research associations brought into existence with the pecuniary aid of the department of scientific and industrial research, it was originally an association of manufacturers, and, although it has received some support from the users of electrical plant, as represented by the electricity supply undertakings, its funds have hitherto been derived chiefly from the manufacturing side of the industry. This fact has given rise to an anomaly, for, while some of the researches it has carried out have been of importance to the manufacturers and have helped them to improve the technical quality of their products, many others have been mainly to the advantage of the suppliers, who indeed, presumably together with the consumers, are said to have received the larger share of the benefits.

In these circumstances it is thought that the supply undertakings, both private and municipal, may fairly be asked to find a greater proportion than hitherto of the annual income required, and an appeal—which has the support of the Electricity Commissioners, the Central Electricity Board, the Institution of Electrical Engineers and the chief associations concerned with the business of supplying electricity—is now being made to them to contribute individually on the basis of a subscription of £10 for each £25,000 of annual revenue derived from their sales. At the same time their claims to increased influence in the management of the association are recognized, and accordingly it is proposed that the constitution of the governing council shall be so modified as to give equal representation to them with the manufacturers, provision being also made for the cooption of a limited number of consumers and others. The excellence of the work already done by the association is admitted. While a money value can not readily be placed upon all its results, it is computed that some of them, through savings in capital, running and maintenance costs, have brought about a reduction in the cost of electricity supply amounting to something like a million pounds annually. Nor is there any reason to suppose that the field is exhausted, or that future effort will not be attended by equally substantial rewards, for many problems requiring solution are already in sight and one technical advance commonly shows the need for another. It is to be hoped, therefore, that the supply undertakings of all kinds, mindful of the interests alike of themselves and of their customers, will do their part in bringing the association's new plans to a successful issue, if only as a token of that gratitude which consists of a lively expectation of favors to come.—*The London Times.*

SCIENTIFIC BOOKS

Plant Ecology. By JOHN E. WEAVER and FREDERIC E. CLEMENTS. McGraw-Hill Book Company, New York, 1929. Large octavo, 522 pp., with 262 figures and one colored map.

AT the beginning of the present century the only book dealing with ecology in the modern sense was a small one by Warming which had recently been translated into German from the Danish. Now there are many, among them the greatly enlarged and extended work of Warming, besides various smaller and larger volumes by writers in England and America.

The book of Weaver and Clements exhibits a great advance over all others in comprehensiveness. In it are presented facts and principles together with practical applications to forestry, grazing and agriculture. Botanists who have not followed the progress of plant ecology will be surprised at the very large amount of material which is now so well known that it may be included in a text-book. Some may, perhaps, question the rather definite and unqualified statements which characterize much of the work, especially the chapter on "Climax Formations of North America."

Terminology and nomenclature are, in general, understandable, and there is only a moderate obtrusion of Clementsian terms. To the reviewer, the short chapter on "Units of Vegetation" is a bit disappointing as compared with Nichols's well-known lucid presentation of the subject.[1] An occasional anthropomorphism appears, as "water-loving" plants. It is unfortunate that the authors did not secure the help of an animal ecologist in preparing the chapter on "Relations between Plants and Animals," a chapter which seems wholly inadequate in a work of the present size and of this present year.

Most of the book deals with the standard material of ecology, as soil, water, temperature, humidity and light. The "Relation of Underground Plant Parts to Environment" is treated in one of the outstanding

[1] *Ecology*, 4: 11–23, 154–170, 1923.

chapters, and another equally to be commended is on "Plants and Plant Communities as Indicators" [of climate, soil, overgrazing, forest and agricultural possibilities].

Throughout the entire book there is evidence of the highest scholarship and painstaking desire for accuracy. The work is likely to be a standard text-book in ecology for many years to come.

Typographically, the volume is well-nigh perfect; one would need to seek far for a more satisfactory example of the printer's art.

FRANCIS RAMALEY

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Grundlinien der experimentellen Planktonforschung. By EINAR NAUMANN. Bd. VI of Thienemann's Binnengewässer, 1929, 100 pp., 18 figs. Published by E. Schweizerbart'sche Verlagsbuchhandlung, Stuttgart.

IN 1908 a limnological laboratory was established at Aneboda, Sweden, in the midst of a series of lakes whose waters contain a great deal of humus. As might be expected the chief activity of this station has been a study of the relation of these humic waters to the biota of the lakes, more especially to the plankton organisms found therein. These studies have involved a large amount of experimental work and the present book is based in a large measure upon these investigations. The author emphasizes the point, however, that actual observations on the lake must go hand in hand with the experimental work in order to secure reliable results.

The first two sections of the book contain brief descriptions of the Aneboda laboratory and its equipment, including the apparatus used for getting samples of the water and of the plankton; the remainder of the book is devoted to a discussion of methods of experimentation upon plankton organisms. Such topics as the vital staining and narcotizing of zooplankton forms, the use of various organisms as indicators for testing the different types of water, the regulation of the reaction and of the dissolved substances in the water used for experimental purposes, and the control of such factors as light, temperature and the mechanical agitation of the water are discussed in some detail. Culture media for rearing different kinds of algae are given, as well as the kinds of food best suited to the various zooplankton forms. The book is an important contribution to the experimental phase of limnological research.

The bibliography contains a list of 205 titles.

C. JUDAY

WISCONSIN GEOLOGICAL SURVEY

SCIENTIFIC APPARATUS AND LABORATORY METHODS

A SIMPLE METHOD FOR FINDING ANY PARTICULAR OBJECT IN A MICROSCOPIC SLIDE PREPARATION[1]

THE various methods proposed from time to time for locating particular fields of a microscopic slide, although fairly satisfactory for work with the low power, are not sufficiently accurate for high-power or oil-immersion work. In all the methods yet proposed, random search, although in limited areas which are determined in various ways, as by readings of mechanical stages, is necessary. The following simple method in which random search is eliminated was thought of a number of years ago. It has proved so satisfactory in my hands in locating organisms difficult of demonstration in stained smears or sections that its description seems worth while. The diplococci represented in the accompanying sketch, for instance, were found in a section of the spinal cord of a monkey in which poliomyelitis developed following injection of virus, and it was very desirable to be able to locate the organisms at will.

The method consists simply of the use of a blank slide, on one side of which is pasted a fairly thin sheet of gummed paper trimmed accurately along the edges of the slide. On either end of this a circle is drawn with a five-cent piece (2.2 cm in diameter). When a micro-organism or another object of particular importance which is to be photographed or demonstrated later is found, a rough sketch (Fig. 1) of the high-power (*H.P.*) of oil-immersion field is drawn in the circle at the left end, and a rough sketch of the low-power (*L.P.*) field in the circle at the right end of the paper-covered slide. In each case, the object of interest is drawn and its position relative to particularly conspicuous material is indicated. Examples of such conspicuous material are masses of pigment, partitions, margins of section, ganglion cells, round cells, (*R.C.*), blood vessels (*B.V.*), and central canal (*C.C.*). The same is done if the slide preparation is a smear instead of a section.

The slide in which a field of special interest has been found is then removed from the mechanical stage and the paper-covered slide, on which the high-power and low-power sketches have been drawn, is put in its place; it is necessary to make sure that the mechanical stage is not jarred and that the slide is in the proper position. A dot is then made with pen and ink as nearly as possible in the center of the bright area transmitted from the condenser. The low-

[1] Submitted for publication April 15, 1929.

power lens is then focused on the dot and its situation in the field noted. The paper-covered slide is then removed and the situation of the dot in relation to the field is indicated with a small circle around the dot (*o.k.*). The dot illustrated in Fig. 1 was far to the

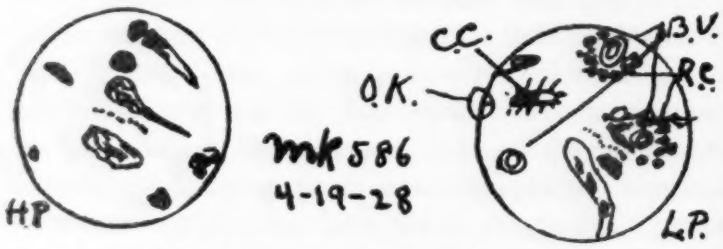

Fig. 1. Paper-covered indicator slide on which the object of interest, the chain of diplococci, is sketched in its relation to conspicuous objects in the high-power and low-power fields.

right of the center of the field. The paper-covered indicator slide is then numbered to correspond to the slide containing the prized field and both are filed away together for future reference. If more than one interesting field is found in the same slide, any number of additional indicator slides may be used.

To find the particular field or fields later, the indicator slide is put in place, and the dot brought to the relative position in the low-power field as indicated by the circle surrounding it. The slide containing the object is then put in its place, the low-power field is oriented, and the object of interest brought to the center of the field, as indicated by the sketch shown in Fig. 1. The high-power or oil-immersion lens is then turned into position and the prized object is almost always within the field, and if not it can readily be located.

It is desirable that the fixed end of the mechanical stage of the microscope used for photography or demonstration be the same as the one used when the field was first found because microscopic slides are usually not of exactly the same length.

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SPECIAL ARTICLES

STUDIES OF MEAN SEALEVEL

In a former issue of this journal[1] there appeared a brief account of sealevel studies undertaken in New York waters to test the theory, advanced by the writer, that along an irregular coast mean sealevel is an irregular surface the precise elevation of which varies with changes in the form of the shore. The studies were carried on under the direction of the division of geology and geography of the National Research Council and have recently been completed. The ultimate success of the undertaking must be credited to several agencies which generously cooperated with the National Research Council to make the study possible, particularly the U. S. Coast and Geodetic Survey, which bore the major burden in the joint effort. A full report will be published in the near future covering (a) the theoretical considerations upon which the whole study was based; (b) the tidal observations, including full field data, prepared by Mr. Paul Schureman, of the Coast and Geodetic Survey, for possible use by those who fifty, a hundred or more years hence may wish to make similar observations for purposes of comparison; and (c) the interpretation of results of the tidal observations, especially in relation to problems of more than local interest.

The outstanding results of the tidal observations to be described in the report are as follows:

(a) The tidal range within Jamaica Bay is greater than at Fort Hamilton near the head of the more open Lower (New York) Bay.

(b) Mean sealevel at all three stations in Jamaica Bay is higher than at Fort Hamilton.

(c) Even within the bay the plane of mean sealevel is not level, but is higher at the northeastern station than at the southern and western stations.

(d) Tidal observations at Fort Hamilton extending over a period of thirty-five years indicate no appreciable change in sealevel at that point during the period of observations.

Let us consider the significance of these points in the order named.

(a) Jamaica Bay was selected as the site of the tidal study here described, in part because it was believed that the breadth and the depth of the inlet would admit tidal waters freely and that the relatively small size of the bay, combined with the fact that much of its area is occupied by marshes and mud flats, would prevent the entering waters from spreading far. Hence it was not expected that this locality would present those extreme conditions encountered where a narrow and shallow inlet into a broad and deep bay or lagoon favors a very small tidal range and at the same time a distinctly higher mean sealevel inside the embayment. The fact that the tidal range in Jamaica Bay exceeds that at Fort Hamilton is sufficient indication that the tidal waters do enter and leave the bay with great freedom and show that the locality was well chosen as an example of moderate rather than extreme conditions favorable to variations in the height of mean sealevel. In this connection it should be noted that not only does high water in the bay rise higher than at Fort Hamilton,

[1] "Shoreline Investigations on the Atlantic Coast," Science, n. s., 65, pp. 4–7, 1927.

but that low water also falls lower, showing that the outflowing waters are not unduly impeded by an exit channel greatly restricted in breadth in its lower levels.

(b) That mean sealevel within Jamaica Bay should at all three tide stations prove to be appreciably higher than at Fort Hamilton, despite the relatively free ingress and egress of tidal waters, and other conditions generally unfavorable to the development of sealevel differences, is most significant. The shape of the inlet channel may account for part of the observed difference in sealevel height, and there might thus be a higher mean sealevel in the bay if no other factor than the tidal régime as affected by the shore form entered into the picture. But other factors are doubtless involved. Some fresh water from the surrounding land enters the bay, although the locality was selected in part because the quantity of this water was believed to be small. Partial impounding of this water, and its lower density as compared with the sea water, would both tend to raise sealevel slightly within the bay. Winds from a westerly direction have in this region a greater average intensity than those from an easterly direction, and due to the form and position of the mouth of Jamaica Bay westerly winds should be more effective in blowing water into the bay and holding it there than would be the case at Fort Hamilton. Just as the shape of the entrance channel may distort the position of mean sealevel, so also the form of channels, shoals and bordering island and mainland shores within the bay may have their effect. None of these factors should produce a great effect in the Jamaica Bay region but each may play a minor rôle. The observed differences in mean sealevel are thus presumably the resultants of a combination of causes, each producing a very limited effect because of the physiographic conditions of the locality.

The quantitative values of the observed differences in mean sealevel are quite as great as, if not greater than, were anticipated. From the physiography of Jamaica Bay and its surroundings it was predicted that the differences found would be "very small, at most a very few inches and possibly only fractions of an inch." It was thus considered quite possible that the maximum values might not amount to an inch. In fact, the difference at one station in the bay amounted to 2.04 inches, at the other two stations to .72 and .84 inches, respectively, as compared with mean sealevel at Fort Hamilton. That the predicted values should be equaled or exceeded by the observed values gives one added confidence that distortions of the mean sealevel plane may safely be inferred from a consideration of the physiography of a given shoreline. In the light of these results it seems reasonable to believe that much greater distortions of the mean sealevel plane must exist at many points along our coast, while smaller but appreciable distortions may be expected in some of our bays and harbors widely open to the sea.

(c) It is not surprising to find that mean sealevel within Jamaica Bay itself varies more than an inch in altitude. The greater altitude at the northeastern station (North Channel Bridge) may reflect a slope of sealevel due to distortion by westerly winds. It may also be in part due to the shoal character of the water in this locality, or to the form of neighboring tidal channels. The same principles which apply to distortion of mean sealevel by larger features of the shore apply in appropriate measure to distortions caused by lesser features within a bay.

(d) Special interest attaches to the long series of tidal observations at Fort Hamilton. These cover a period of thirty-five years (1893 to 1927, inclusive).

The tabulated data afford no proof of any progressive change in the general level of land or sea. The annual variations, the four-year variations and the nine-year variations are all within the limits of variations normally due to astronomical and meteorological causes. A more or less steady rise of sealevel from 1912 to 1919 was followed by a more or less steady fall from 1919 to 1926. The average position of mean sealevel for the first five years of the 30-year period 1898–1927 differed from that of the last five years by only 0.01 foot or little more than one tenth of an inch. Obviously there is nothing thus far revealed in the Fort Hamilton record which can be taken to indicate a progressive rise of the general sealevel, or a progressive subsidence of the land.

Should future years show that in the long run local sealevel continues, on the average, to rise, it would then be necessary, before assuming a general rise of sealevel or subsidence of the land, to eliminate the possibility that the change was merely local and due to changing conditions within the harbor or on adjacent shores. In this connection it would be necessary to study past and future changes in Coney Island, Rockaway Beach and Sandy Hook and perhaps along other parts of the coast of the Lower Bay; the effects of artificial changes in the Lower and Upper Bays and in neighboring waters, including the dredging of channels, building of jetties, obstruction of currents by wharves and piers, filling in of harbor areas, etc.; possible changes in the volume of fresh water brought by the Hudson and other streams, and all other factors which might locally affect the position of the sealevel plane. It will be an appropriate time to make this study after we have first found in the tidal records indications of sealevel changes which are not readily explained as

normal and expectable fluctuations due to astronomical and meteorological causes.

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SEGREGATIONS OBSERVED IN BREEDING THE MONILIA BREAD MOLDS

IN the heterothallic species of Neurospora, two nuclei bearing factors of inheritance from both parents come together in an ascus and fuse. After a short resting period the fusion nucleus undergoes three successive divisions. Each of the resulting nuclei is then included in a spore. Eight uninucleate unisexual ascospores are thus formed from a single mother cell. The asci are long and slender and the nuclear spindles are very definitely oriented so that the relationship of the different spores is readily determined. The results obtained in crossing different strains as well as species of the Monilia bread molds have been such as to suggest the desirability of knowing in each case just where segregation of the various factors of inheritance takes place.

Neurospora crassa is a species commonly found on sugar-cane bagasse and elsewhere in the south. The eight spores from each of several asci have been isolated one by one and germinated. The eight haplonts, each from a single spore and all from a single mother cell in each case, were grown in pairs in all possible combinations. The results prove conclusively that segregation of the sex factors occurs in the first nuclear division in the ascus. The four spores in one end of the ascus are all alike as to sex, and the four in the other end of the ascus are of the opposite sex.

Neurospora sitophila, the common pink mold of the bakery, resembles *N. crassa* in many respects, but it has been reported[1] that in this species segregation of the sex factors must occur in the second division because the spores alternate in pairs as to sex. That this is not always the case is evident from results recently obtained by the writer. The strains mated were originally obtained at the Arlington Experimental Farm in Virginia. Eight haplonts were obtained by germinating the spores from one ascus. After the cultures had developed a few days very striking differences could be seen. The cultures had been numbered 1 to 8 corresponding to the location of the spores in the ascus. There was a very definite alternation in pairs as to the color of the aerial hyphae and the amounts of the salmon-pink conidia produced. Mycelia Nos. 1, 2 and 5, 6 produce pale or albinistic aerial hyphae with few, if any, conidia. Mycelia Nos. 3, 4 and 7, 8 produce masses of brightly colored salmon-pink to orange conidia. By growing the eight haplonts in pairs in all possible combinations, however, it was proved that this alternation in pairs was independent of sex. The haplonts alternate four and four as to their sex, so that as in *N. crassa* segregation of the sex factors must occur in the first division, even though the factors for conidia segregate in the second division. By mating haplonts Nos. 2 and 7 a new generation of perithecia was obtained. The same alternation in pairs as to production of conidia, and alternation four and four as to sex, was proved to obtain in asci of these perithecia also.

Quite otherwise is the situation when two albinistic races such as Nos. 2 and 6 are mated, or when two strains such as Nos. 4 and 8, which produce an abundance of conidia, are grown together. For example, when haplonts Nos. 2 and 6 are mated a new albinistic race is established which produces few, if any, conidia even when grown on bread, its natural medium. Such a race would be less obnoxious to the baker, since it must rely on sexual reproduction for its perpetuation. The spores from the different asci were tested out as to their sexuality. While the eight haplonts from an ascus are all alike in being albinistic, and practically sterile as to production of conidia, it was found that as to sex the spores alternate in pairs. When haplonts Nos. 4 and 8 referred to above were mated, asci were developed in which all eight spores were alike as to production of conidia by their mycelia, but again the spores alternate in pairs as to their sex.

Neurospora tetrasperma is a homothallic species. The mechanism by which a spore is provided with a nucleus of each sex is rather remarkable. Segregation of the sex factors could occur in any one of the three divisions, yet each ascospore would ordinarily be bisexual.

The three species of Neurospora furnish very desirable material for studies on inheritance in the fungi. Perhaps in no other place in the plant or animal kingdoms so far known can the progeny from a single mother cell be studied so readily and to such an advantage. Just why, in a mating of strains of *Neurospora crassa* which appear to be homozygous as to factors for production of conidia, segregation of the sex factors should occur in the first division in the ascus, while in similar races of *N. sitophila* these factors are segregated in the second division, is not altogether clear. Further study proves that segregation of various factors of inheritance in *N. sitophila* may occur at different points, depending on certain conditions not yet clearly understood.

B. O. DODGE
THE NEW YORK BOTANICAL GARDEN

[1] Marguerite S. Wilcox, "The Sexuality and Arrangement of the Spores in the Ascus of *Neurospora sitophila*," *Mycologia*, 20: 3–17. 1928.

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PAPERS READ BEFORE THE INTERNATIONAL PHYSIOLOGICAL CONGRESS

EXPERIMENTS on turtle hearts indicate that this organ will select alcohol and reject nutrients derived from meat when given a choice. The researches in question were reported by Dr. L. D. Seager and Professor W. E. Burge, of the University of Illinois. Turtle hearts were chosen for the experiment because they stay alive for many hours after they have been removed from the bodies that once housed them, beating practically in normal fashion. They were given a synthetic "blood" containing necessary nutrients. These consisted of aminoids and amino-acids, substances known to chemists as the "building-stones" of proteins. Some of the hearts received nothing but these nutrients, some the nutrients plus alcohol and a third group nothing but alcohol. The hearts receiving the "mixed" ration made use of most or all the alcohol, rejecting part of the protein fractions, while the hearts kept on a diet of alcohol only used up all of it.

The enzymes, or digestive juices, of animals and even of the larger plants are easy to extract, and physiologists have worked with them for a long time. But the enzymes of such exceedingly minute things as bacteria have so far proved impossible to isolate. However, Professor E. Gordon Young, of Dalhousie University, has succeeded in getting germ enzymes, not by squeezing but by freezing. He took a considerable quantity of one type of the common colon bacillus, and subjected it to repeated freezings and thawings. This killed the cells and allowed their enzymes to come out, and subsequent filterings removed the extract from the débris of the dead cells. He was then able to test their digesting powers on various nutrient media.

Without green vegetables even a diet rich in vitamins A and B, hitherto supposed to be the indispensables in blood-making, will not prevent the onset of anemia, according to Dr. A. Zih, of Debrecen, Hungary. Dr. Zih fed rabbits on a balanced diet, including the necessary vitamins, excluding, however, fresh vegetables. They developed anemia. He then gave them green grass, and the anemia was arrested. Dr. Zih obtained the same results with chlorophyll, the stuff that makes green leaves green, when he gave it to his rabbits instead of grass. This would seem to indicate that the chlorophyll, or some part of it, plays an essential rôle in the formation of red blood corpuscles.

The secretion of the thyroid, the highly important shield-shaped gland in front of the throat, whose over-development constitutes goiter, plays a notable part in the development of color in the feathers of birds, according to Dr. Boris Zavadovsky, of Moscow. In one series of experiments he fed a tenth of a gram of thyroid a day to young chickens. This brought on the development of color in their feathers; but when the dose was raised to half a gram a day the process was reversed and depigmentation set in. In other experiments, young male birds developed new feathers of "female" shape on plucked areas; that is, the new feathers had rounded ends like hen feathers instead of the pointed tips characteristic of cockerels. But, in sexually immature pullets and in castrated birds of both sexes, thyroid dosing caused the development of feathers colored like those of the male.

While controversy in this country has risen high over the advantages and drawbacks of iodized salt and iodized drinking water, Finland has developed a method of dealing with its goiter problem that seems to offer multiple advantages. The more indirect method of getting iodine into the human system by feeding a weak iodized mixture of mineral salts to farm animals has been attended by considerable success, according to Dr. George Von Wendt, of Helsingfors. This method seemed especially promising, he pointed out, in a dairy country like Finland where the consumption of milk and milk products is very great. When a goiter survey was made, however, it revealed the fact that the affection was very common in domestic animals, particularly in pigs and horned cattle. "In districts with much human goiter," declared Dr. Von Wendt, "only a few of the calves were without goiter. On one of the greatest estates for experimenting we found 72 per cent. of the calves with goiter before administration of the iodized mineral salt. After a year of application to the milk cows the number decreased to only two per cent." Half a year's feeding of the iodized mixture was also observed to have a beneficial effect on the rate of calving in previously sterile cows.

NEUJMIN'S COMET

THE celestial object discovered by Dr. G. Neujmin, at the Simeis Observatory in Russia, on August 2, is really a comet that approached closest to the sun during the past spring and is now receding to the outermost parts of the solar system. These calculations, announced by Professor A. O. Leuschner, professor of astronomy at the University of California, demonstrate definitely its cometary character. At first it was supposed that the object might be a tiny planet or asteroid.

In the meantime, observations made at the Lick Observatory, on Mt. Hamilton, by Drs. C. J. Krieger and N. T. Bobrovnikoff, have shown the object to have a sharp nucleus like a star, but to be surounded by a small nebulosity. This also shows it to be a comet.

According to the calculations of its path, Neujmin's comet reached perihelion, the time of closest approach to the sun, on April 16, when it was 200 million miles away from the sun. However, Professor Leuschner points out that these figures are uncertain, because of the inconsistency of some of the observations. The comet is still of about the fourteenth magnitude, and is slowly moving from the constellation of Aquarius into the neighboring one of Capricornus. Both of these are in the southeast evening sky.

While observing the comet, Drs. Krieger and Bobrovnikoff discovered another strange object close to it, moving

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in the same general direction, but much fainter. In the opinion of Dr. J. H. Moore, of the Lick Observatory, this is probably an asteroid, a member of the large family of tiny planets, some only a mile or so in diameter.

THE CRYSTAL CLOCK

A CRYSTAL of quartz, similar to those used in radio stations to keep the wave-length constant, may make possible a new era of accurate clock making. Experiments at the Bell Telephone Laboratories, New York, by Dr. W. A. Marrison, have shown that such a crystal may be made to perform the work of a clock pendulum. Already he has constructed a timepiece that compares in accuracy with the very best of observatory clocks until a few years ago. Since a pendulum is not required, the crystal clock does not require the firm pier on which observatory clocks must be mounted. The crystal clock could be used in a tall office building, on shipboard, or even in aircraft if needed.

When a quartz crystal, properly cut, is placed between two metal plates, and a vibrating electric current applied to them, the crystal can be made to oscillate at a certain rate. By varying the size of the crystal, the rate at which it vibrates can be regulated, and the crystal maintains the same rate with great accuracy. This is used in crystal controlled radio stations.

But a much higher accuracy is needed for a laboratory standard, and this has been attained by Dr. Marrison. His apparatus has been developed primarily as a standard of frequency. The application as a clock is a by-product, but one which may eventually prove of even more practical importance.

Three crystals are used by Dr. Marrison, each vibrating 100,000 times a second. Each crystal is enclosed in a thickly padded chamber to prevent temperature changes and the whole is covered with a glass bell jar, so that the air pressure and humidity may also be kept constant. Three separate oscillating electric circuits from vacuum tubes keep the crystals running, so from each unit there comes an alternating electric current, changing exactly 100,000 times a second. Any one of these three crystals can be connected with the clock, through the medium of another electrical circuit called a "submultiple generator," also using vacuum tubes. One of these takes in the 100,000 cycle current and gives out current alternating 1,000 times a second. This current operates a motor, geared to the clock face in such a way that it keeps accurate time when the crystal vibrates accurately. A contact on this clock gives an electrical impulse every second.

Though the clock has not been running long enough to check its accuracy over long periods, shorter observations show it to keep a constant rate within about a hundredth of a second a day. This is comparable in accuracy with the Riefler clocks that were the most accurate available until a few years ago, and which are still used as the U S. Government standard in Washington. A new clock recently developed in England, however, known as the "Synchronome," is still more accurate, and is now coming into extensive use in observatories and laboratories. Dr. Marrison hopes by future refinements to be able to make the crystal clock as accurate.

ADJUSTABLE PROPELLERS FOR AIRCRAFT

PROPELLERS for airplanes, made adjustable so that their pitch, or "pulling power," can be adjusted in flight as the occasion arises, will soon come into extensive use, is the opinion expressed by engineers attending the Aeronautic meeting of the Society of Automotive Engineers at Cleveland. Two separate papers were presented on the subject. One was by T. P. Wright and W. R. Turnbull, engineers of the Curtiss Aeroplane and Motor Co., the other by Frank W. Caldwell, chief engineer of the Standard Steel Propeller Company. All three agreed that the controllable pitch propeller is well worth the added cost for many types of airplane.

The propeller acts in the air like a screw in wood, and its pitch is the same as the pitch of a screw. That is, it is the distance that the screw will advance when turned once. As the air is a less substantial medium than a piece of wood, however, the propeller slips a bit, and the practical pitch is somewhat less than what it would be theoretically. The greater the angle the blades of the propeller make with the path in which they turn, the larger is the pitch. All present-day propellers in general use are of fixed pitch; they can not be changed while the plane is in the air, though some can be adjusted between flights.

In such a propeller, said Mr. Wright and Mr. Turnbull, "assuming good design, the propeller will be just right for the case of top-speed level flying and full-open throttle, with the engine running at its normal rated number of revolutions per minute and the efficiency of the propeller will be the maximum for this one condition of flight. For any other condition of flight, the propeller will be less efficient and the over-all efficiency of the airplane will decrease, and, under some conditions, to a very considerable extent."

Various methods have been tried for controlling the blades, but the best type is one in which a small electric motor, operated by a storage battery, is geared to the propeller and controls it. It was predicted that it could be designed so that the weight of the rotating parts would be no more than 20 to 30 per cent. greater than with ordinary propellers. This electric control makes possible a close control of the angle of the blades.

"If the added weight can be kept reasonably low, the great advantages in performances resulting from the use of a propeller that will give good efficiency at all conditions of flight and also allow the full power of an engine to be delivered when most needed will offset many times the disadvantages of a heavier propeller," they said.

Gearing of aircraft propellers was another problem to engage the attention of the engineers. Mr. Wright and his associate, R. E. Johnson, stated that the use of gearing to reduce the speed of the engine as applied to the propeller will come into wide use in heavy multi-engined transport planes. On lighter engines, giving less than 400 horse-power, and in airplanes weighing less than 4,000

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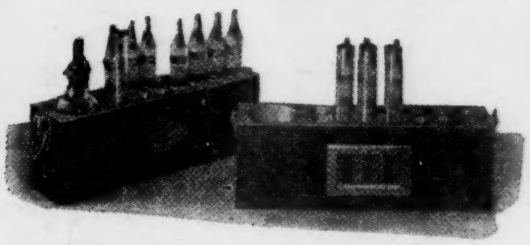

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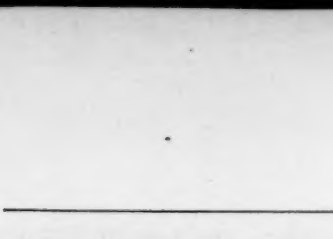

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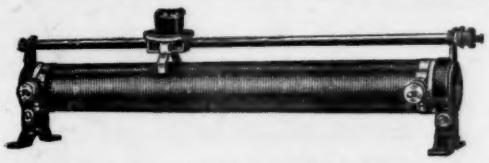

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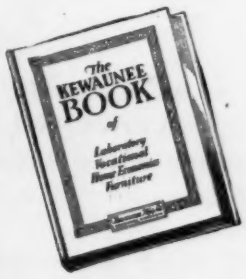

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TRACES OF RADIUM

RADIUM, in almost infinitesimal amounts, is to be found in all living plants and animals. It is gathered up by them and concentrated from its even thinner distribution in natural soils and waters. This is the claim advanced by Professor V. J. Vernadsky, member of the Russian Academy of Sciences, after investigations conducted at the Russian State Radium Institute and the Biogeochemical Laboratory.

Surface water from a freshwater pond tested at the laboratory showed the presence of radium in almost inconceivably small amounts. Its concentration would be represented by the fraction 68/100,000,000,000,000, or 68 one-hundred-trillionths of one per cent. A sample from a deeper part of the pool contained somewhat more.

But two species of floating duckweed scooped off the pond's surface showed the presence of 39 one-hundred-billionths of a per cent. of radium, or over 56 times as great a concentration as was found in the water, and this in spite of the fact that over 90 per cent. of the plant itself consists of water. Different species were found to have characteristic concentrations of radium peculiar to themselves.

Tests of land plants and water animals showed rather less radium than was present in the water plants. In them the average concentration was of the order of one one-hundred-billionth of one per cent.

ITEMS

THE elimination of certain poisons from the system, normally the task of the kidneys, can be imposed on the sweat glands of the skin when the kidneys are afflicted with nephritis, putting them out of commission. Dr. Frederick M. Allen, of Morristown, N. J., has used a dry heat treatment on his patients to induce this health-restoring perspiration. Harmful protein compounds are reduced by this means, and abnormal conditions due to the presence of too much water in the body are also corrected. Blood-pressure is but little affected, but it is necesssary to exercise a certain caution in administering the treatment to cardiac patients.

DEMONSTRATING the much-mooted effect of moonlight on starch by means of a chemical trap to catch a shadow was the feat reported before the meeting of the British Association for the Advancement of Science by Miss E. Semmens, of Bedford College, London. Miss Semmens has for some years been studying the effect of polarized light on starch solutions, which it is claimed are turned into sugar by prolonged exposure. Moonlight is composed largely of polarized sunlight, and it might be expected that it would have an effect on suitably prepared starch. Miss Semmens dipped slips of paper into starch solutions and exposed them to moonlight, covering parts of them with small opaque objects to cast shadows. Then she dipped the paper into an iodine solution, which, as is well known, turns starch black but leaves sugar colorless. Where the shadow had fallen, there was a faint but distinguishable deepening of the color, indicating that sugar had been formed in the uncovered part. She was also able to repeat the same test with leaves containing starch grains.

A MAN'S puzzlement over a fence post which he had painted black but which turned white every night was the starting point of a program of research which has culminated in the discovery of a number of chemicals having this remarkable chameleon-like property scientifically termed phototropy. Information regarding these chemicals has now been made public by the American Chemical Society. The famous fence post was painted with a "pigment having a zinc basis." It would turn black soon after sunrise each morning, only to turn white again when darkness came. Many explanations have been given for the phenomenon, but scientists are not yet agreed as to the cause of it. They have, however, found several other substances besides the zinc sulphide, which was in the paint on the post, that will also change color with the light. Most of the known phototropic liquids are solutions of colorless derivatives of certain dyes. The solutions are practically colorless in the dark but turn the color of the parent dye when exposed to light.

THE danger of introducing new plant-killing pests and diseases on imported nursery stocks has led the U. S. Department of Agriculture to place an embargo on the importation of Mahaleb cherries, Myrobalan plums and other fruit stocks. The decision was made as a result of a conference on July 19, but has just now been promulgated. The two stocks principally affected are widely used in the propagation of cherries and plums, and have been imported in large quantities. Domestic producers declare their ability to maintain a sufficient supply to take care of the domestic demand. The embargo will go into effect on July 1, 1931.

STATION W3XK, of the television laboratory of Dr. C. Francis Jenkins in Washington, is now being operated with new equipment and increased power. Up to the present this station has been using 250 watts in the transmitter at the Washington laboratory. The new station, in one of the suburbs of Washington, uses 1,500 kilowatts at present. The Radio Commission has approved a power of 5,000 watts. Radiomovies are now being broadcast every night from the station, between the hours of 8 and 9 P. M., Eastern Standard Time. One room has been provided at the new station for a television studio, from which broadcasts of living subjects will be made, when the equipment is completed. Airplane television broadcasts will be attempted from the new station before long, according to Dr. Jenkins. He has received a new Stinson airplane from the factory and is equipping it with a television camera which will operate through a hole in the floor of the cabin. The scene will be transmitted by radio to the station on the ground, where it will be picked up and rebroadcast with greater power. In this way scenes of Washington from the air will be sent out over the country.

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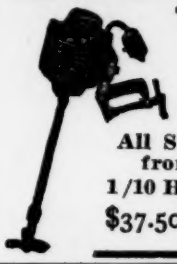

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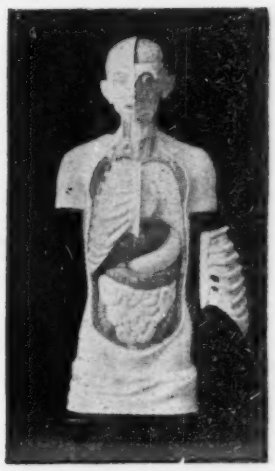

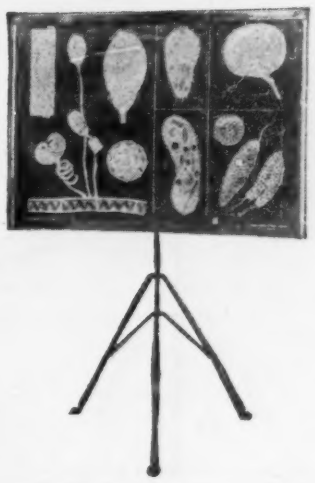

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